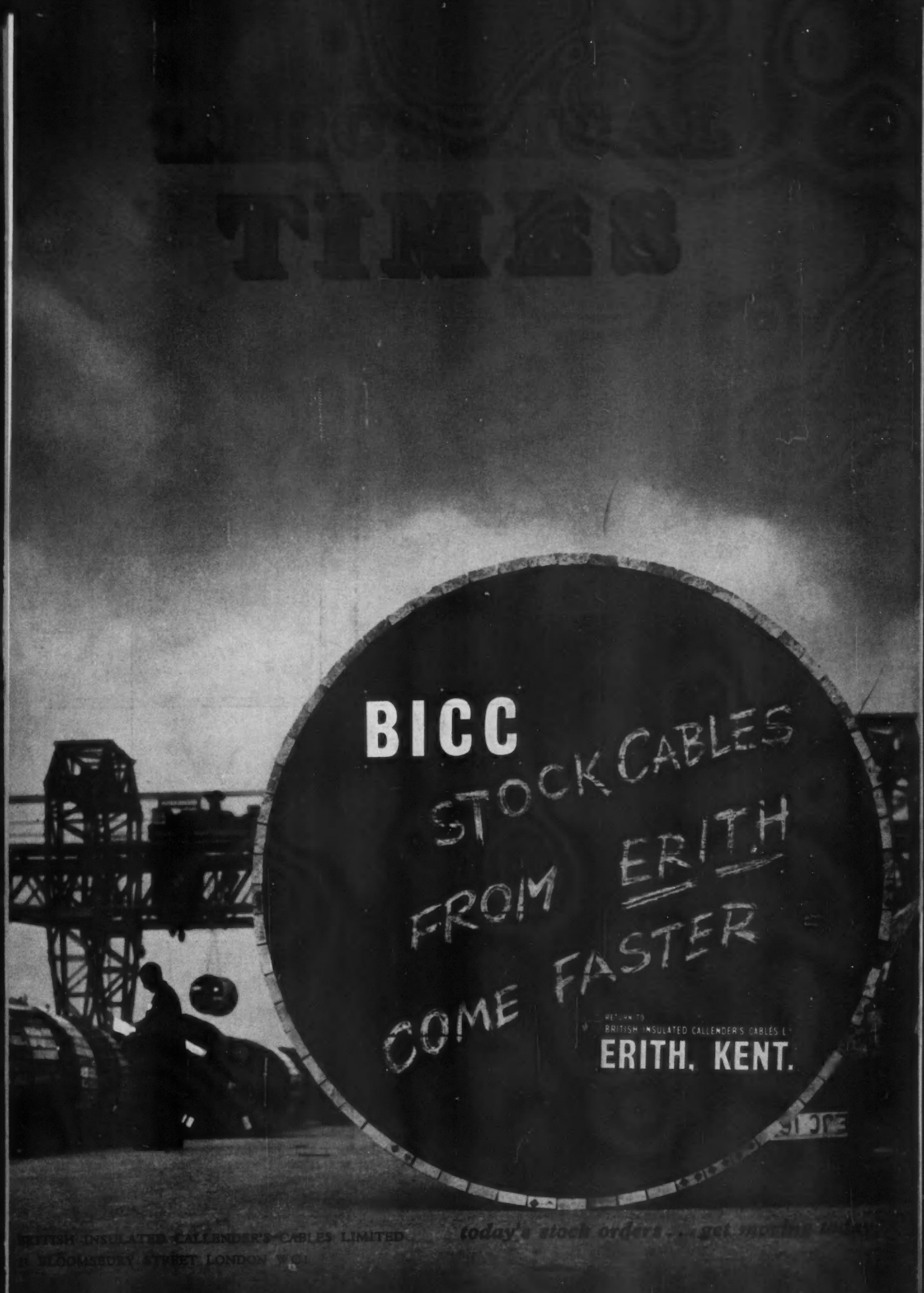

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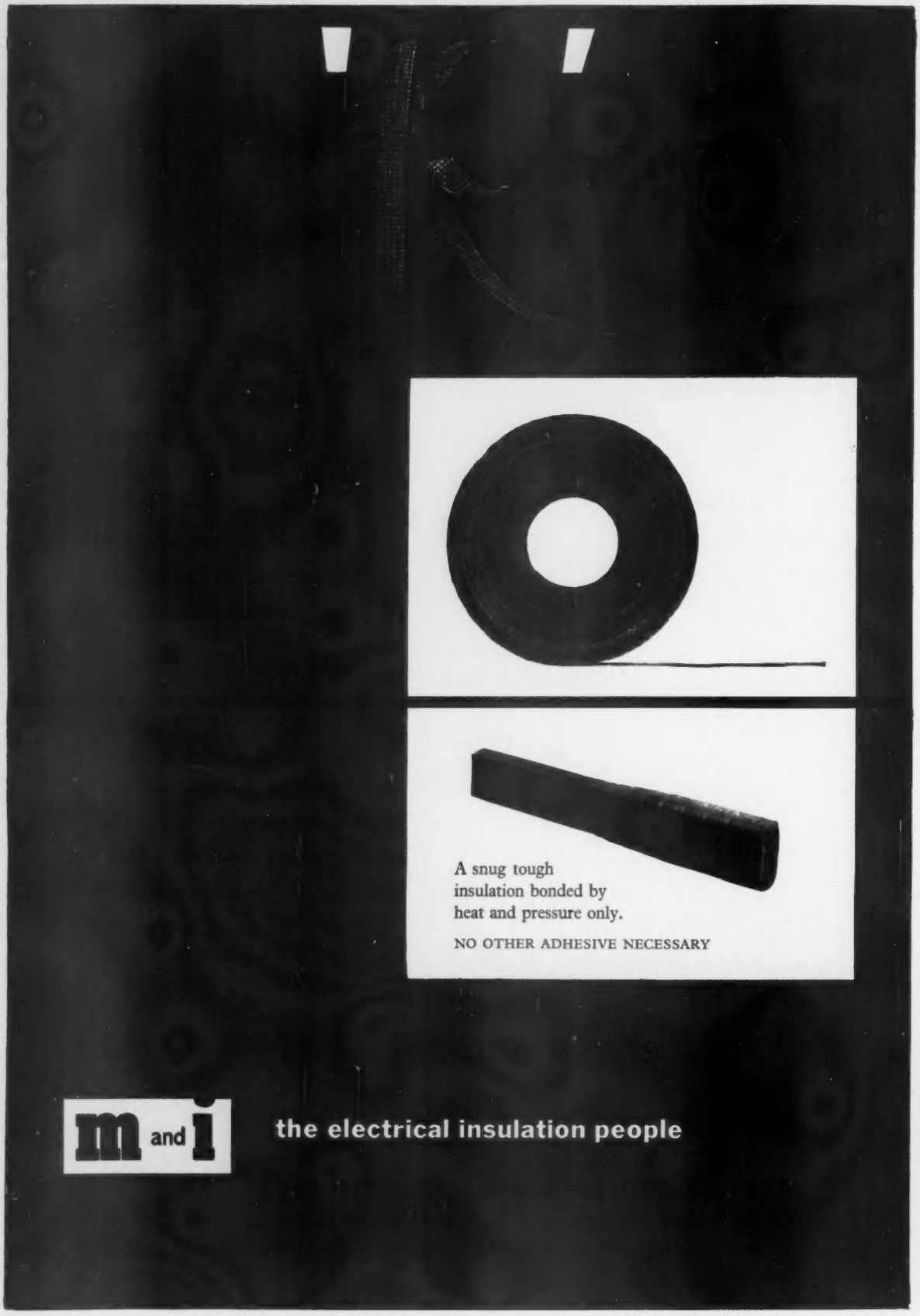
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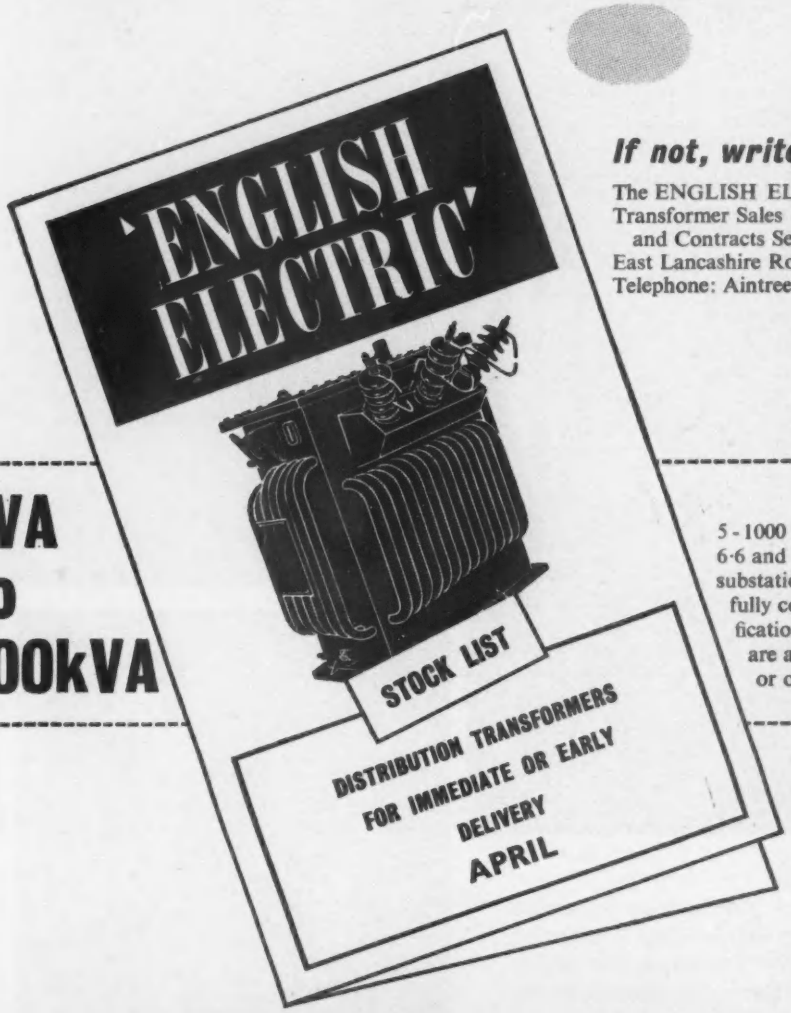

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The ENGLISH ELECTRIC Co. Ltd.
Transformer Sales
and Contracts Section,
East Lancashire Road, Liverpool 10.
Telephone: Aintree 3641

5kVA to 1000kVA

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6·6 and 11 kV pole and substation type transformers, fully complying with Specification B.E.B.S.T.1 (1958) are available EX STOCK or on short delivery.

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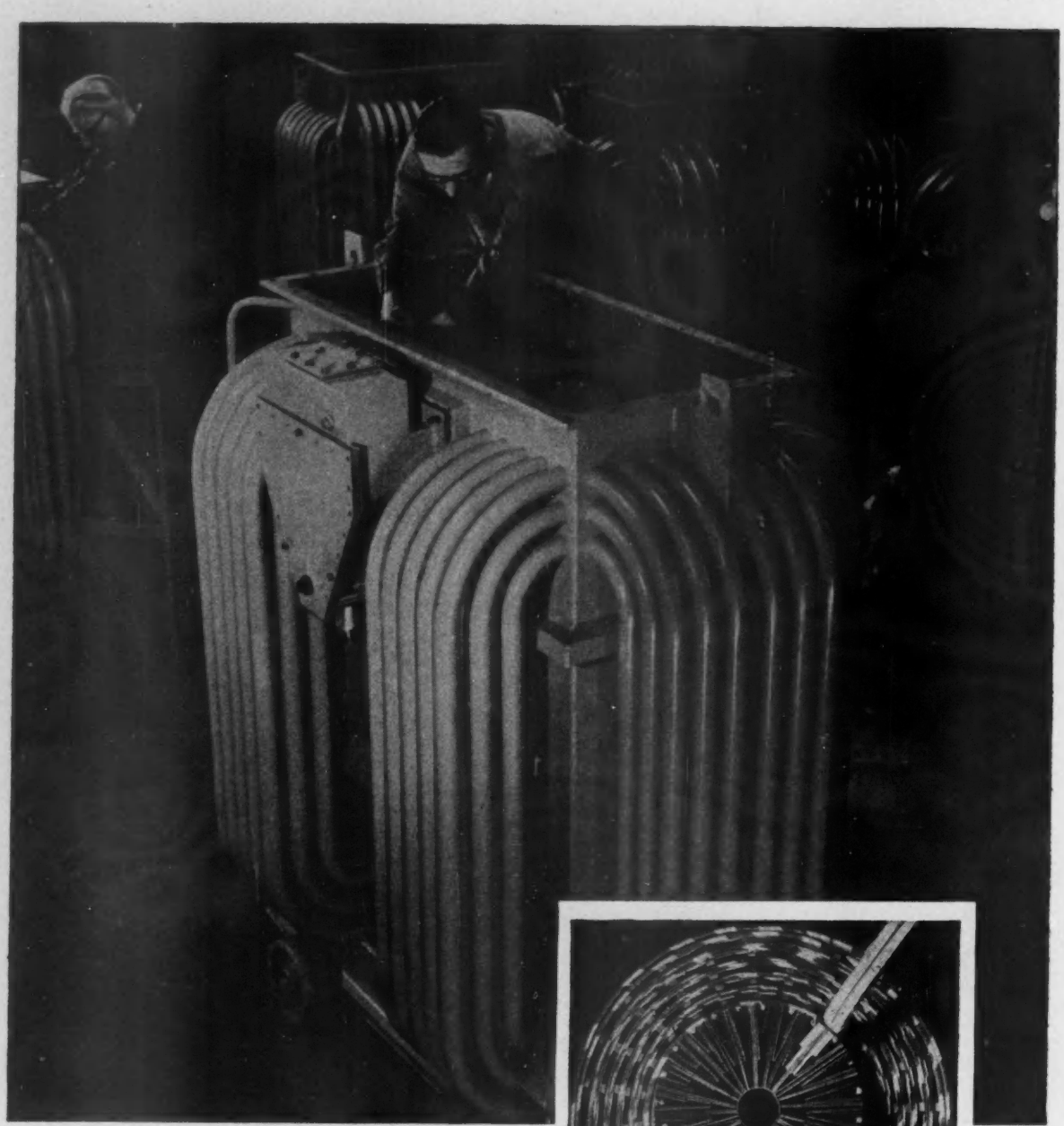
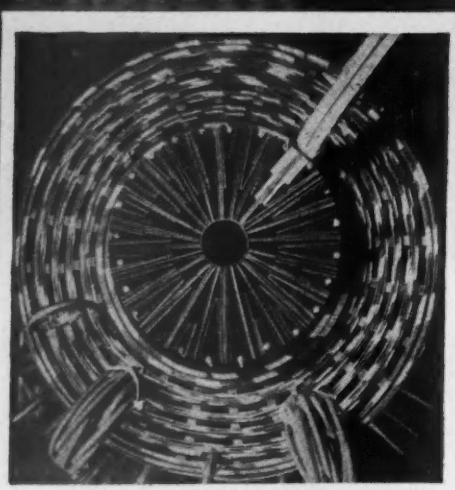


Inside the works a specialist works inside the works of a Lindley Thompson transformer. As you know, this highly respected firm produces extremely efficient power transformers, standard *and* special, in many different sizes.



A bird's-eye view of the winding of a Lindley Thompson radial type transformer.

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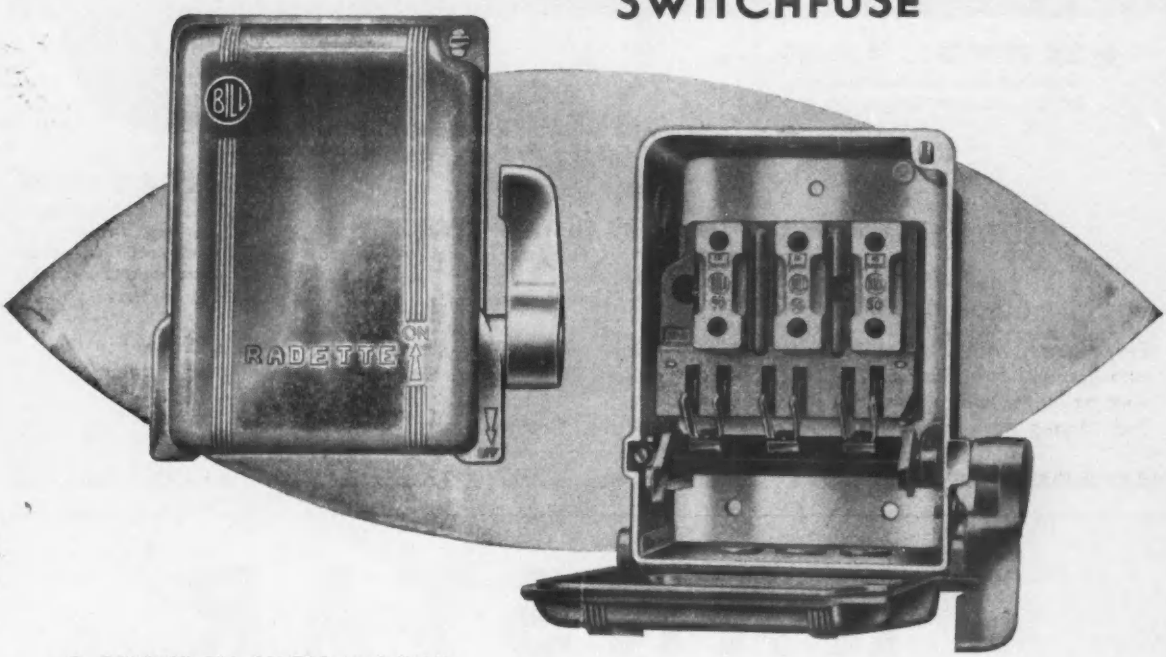

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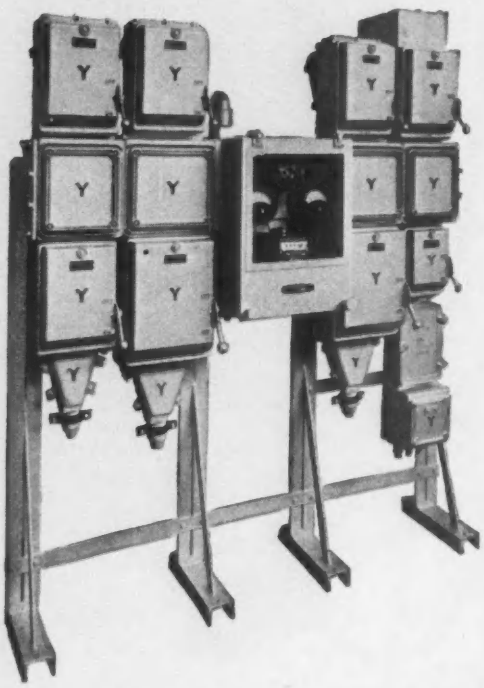

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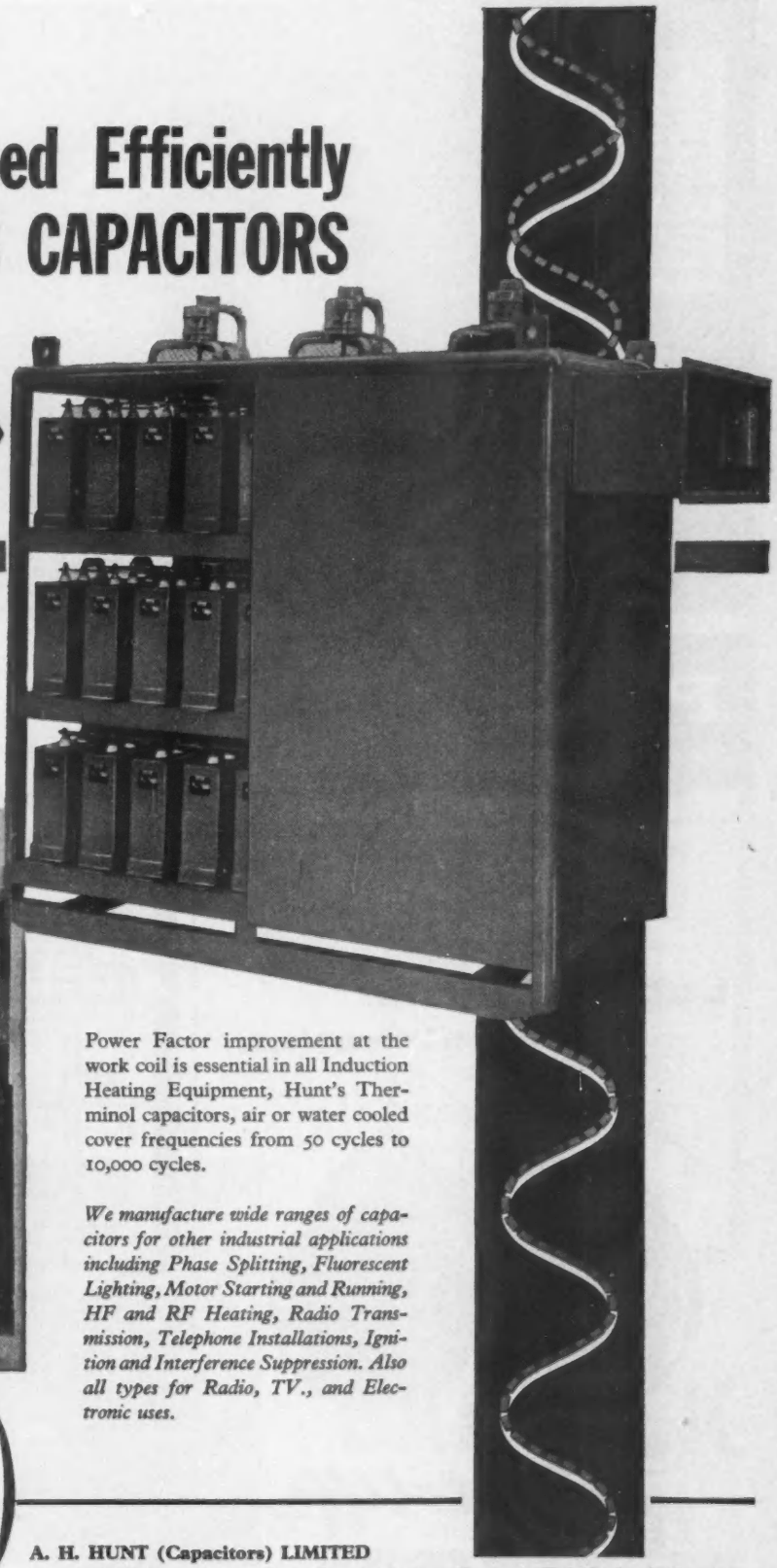
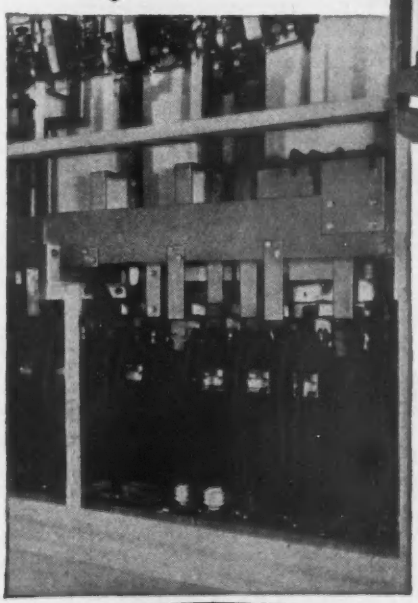


Hunt's Water Cooled Medium Frequency Capacitors. Part of bank for Induction Heating Equipment. Capacitor units of 320kVAr, 1600 volts, 3000 cycles. *(Photo by courtesy of Garringtons Ltd., Induction Heating Division).*



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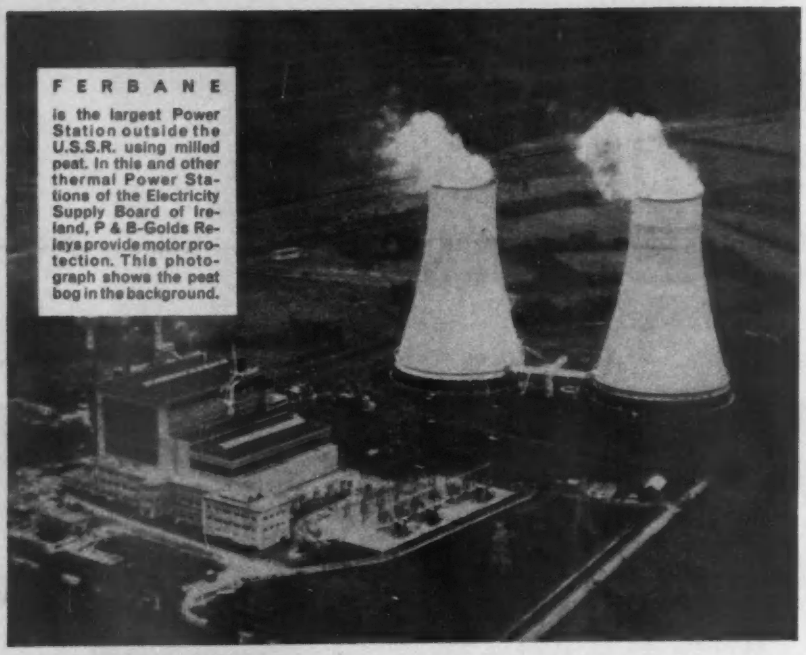

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is the largest Power Station outside the U.S.S.R. using milled peat. In this and other thermal Power Stations of the Electricity Supply Board of Ireland, P & B-Golds Relays provide motor protection. This photograph shows the peat bog in the background.

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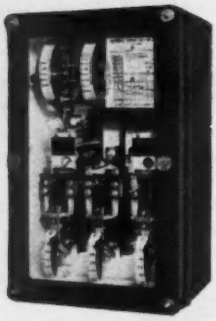

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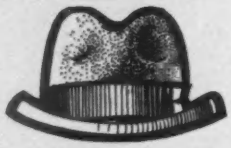
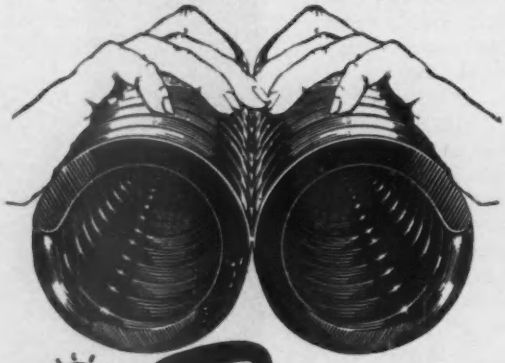


Looking in the right direction



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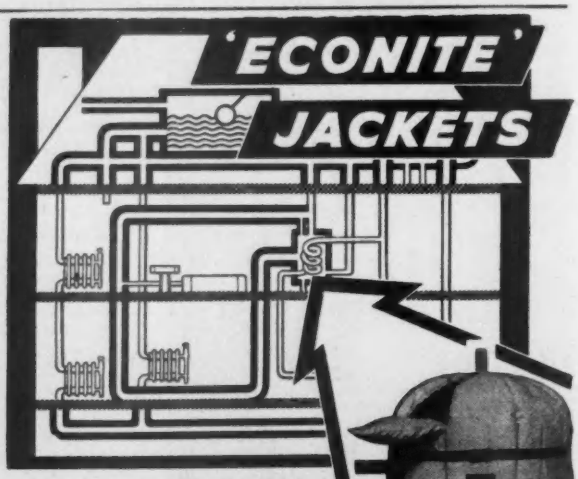

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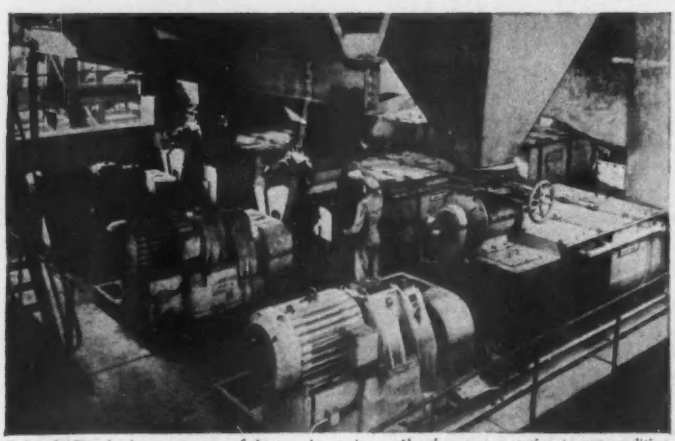

Babcock 'Giant' mixer-conveyors of the type in service at Aberthaw power station to wet-condition fly-ash for disposal from dust silo to vehicles.

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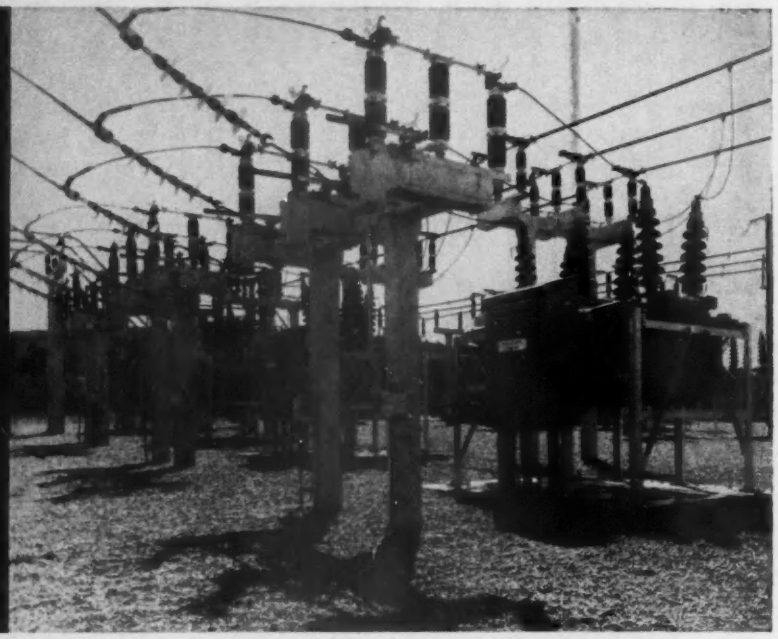

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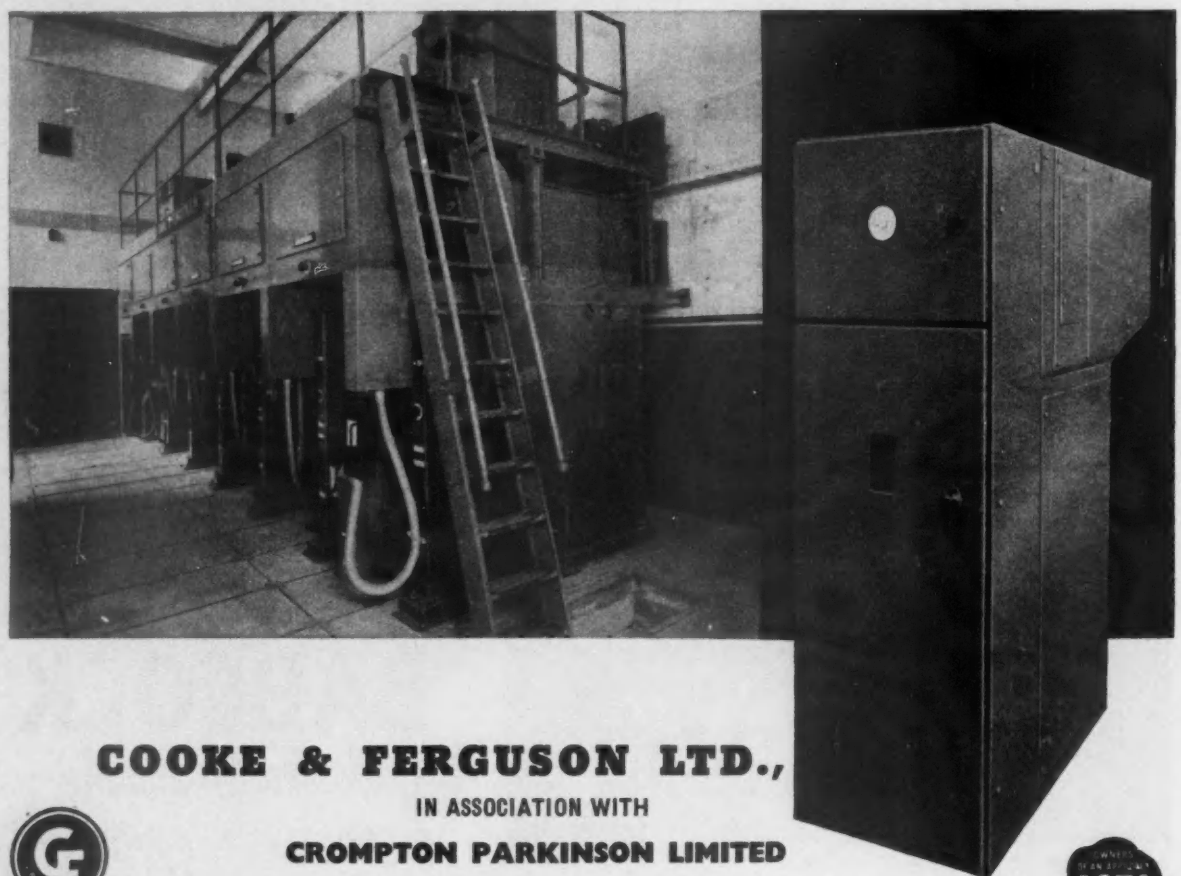

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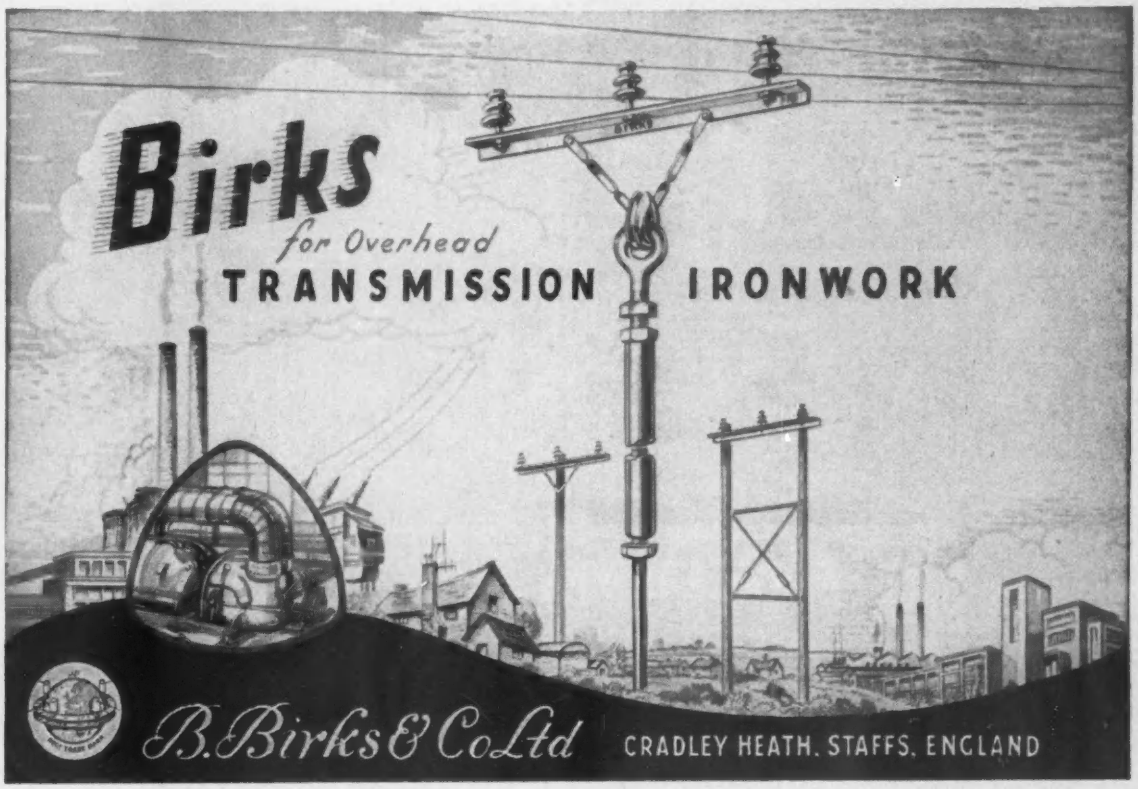
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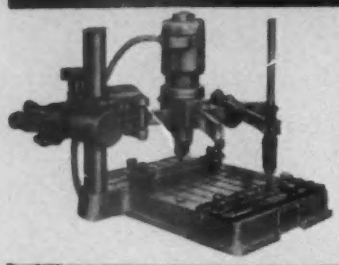

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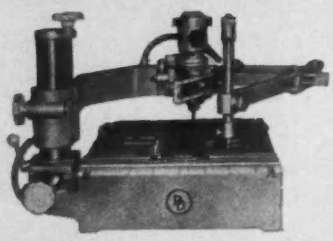

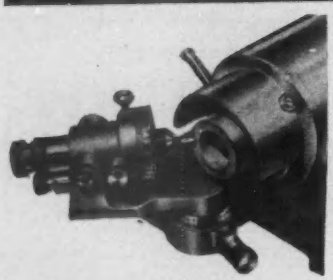

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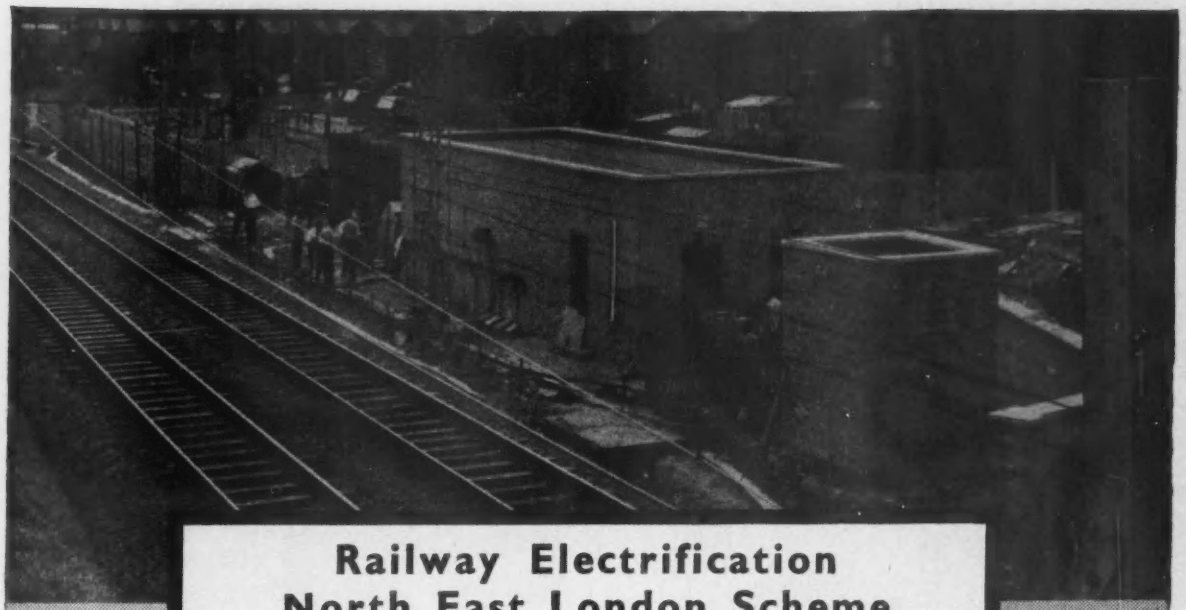

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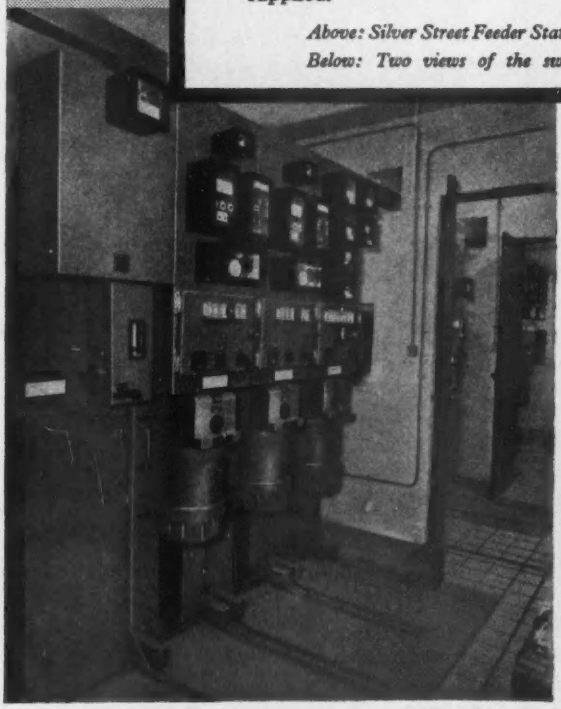
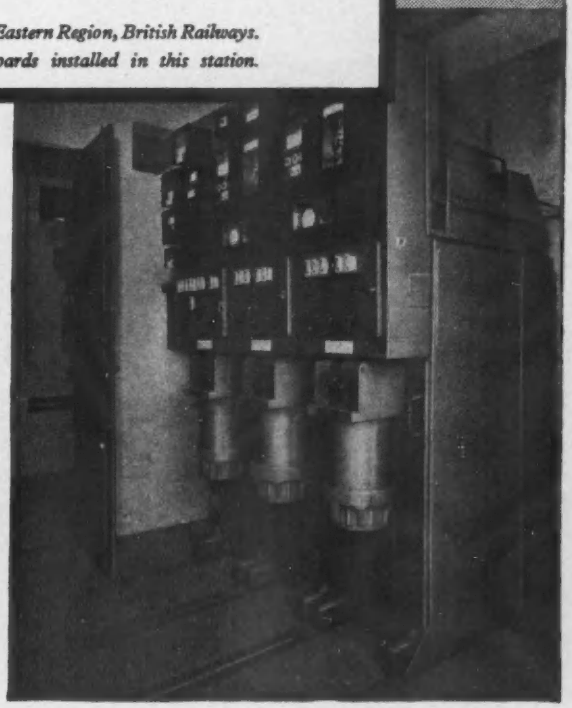
Above: Silver Street Feeder Station, Eastern Region, British Railways.
Below: Two views of the switchboards installed in this station.





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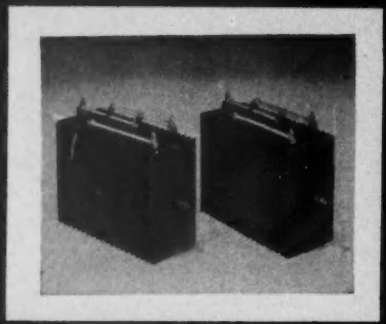

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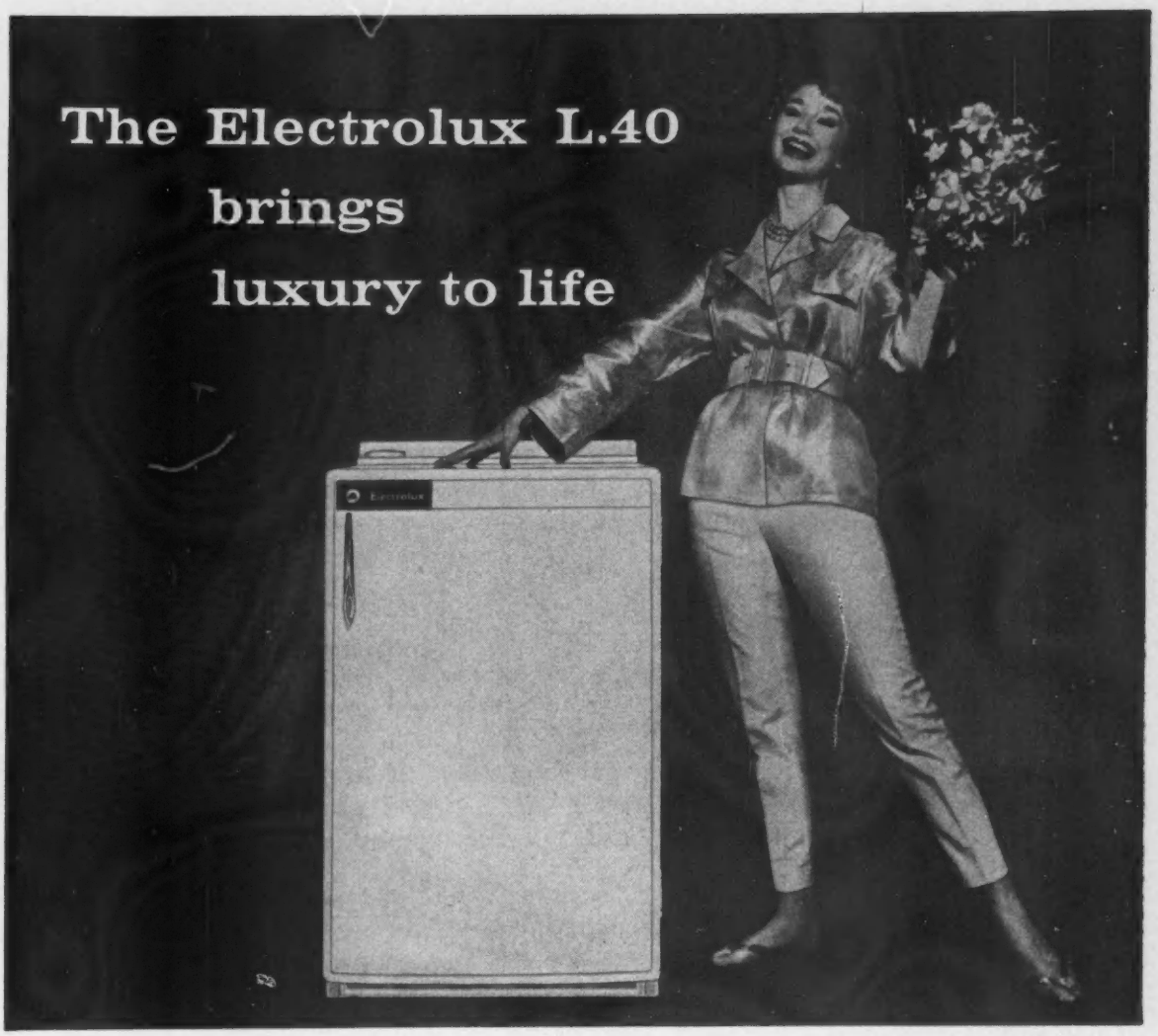

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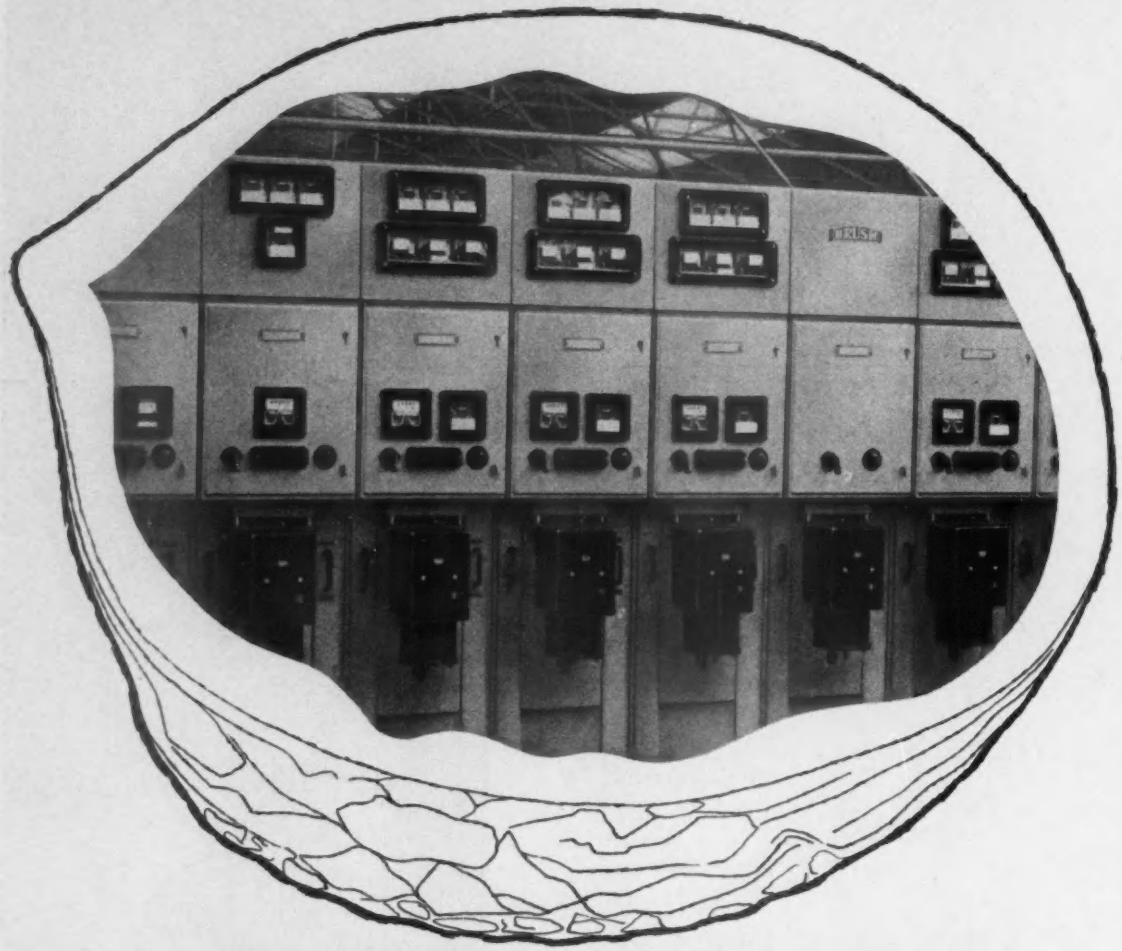

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NEWS SHEET

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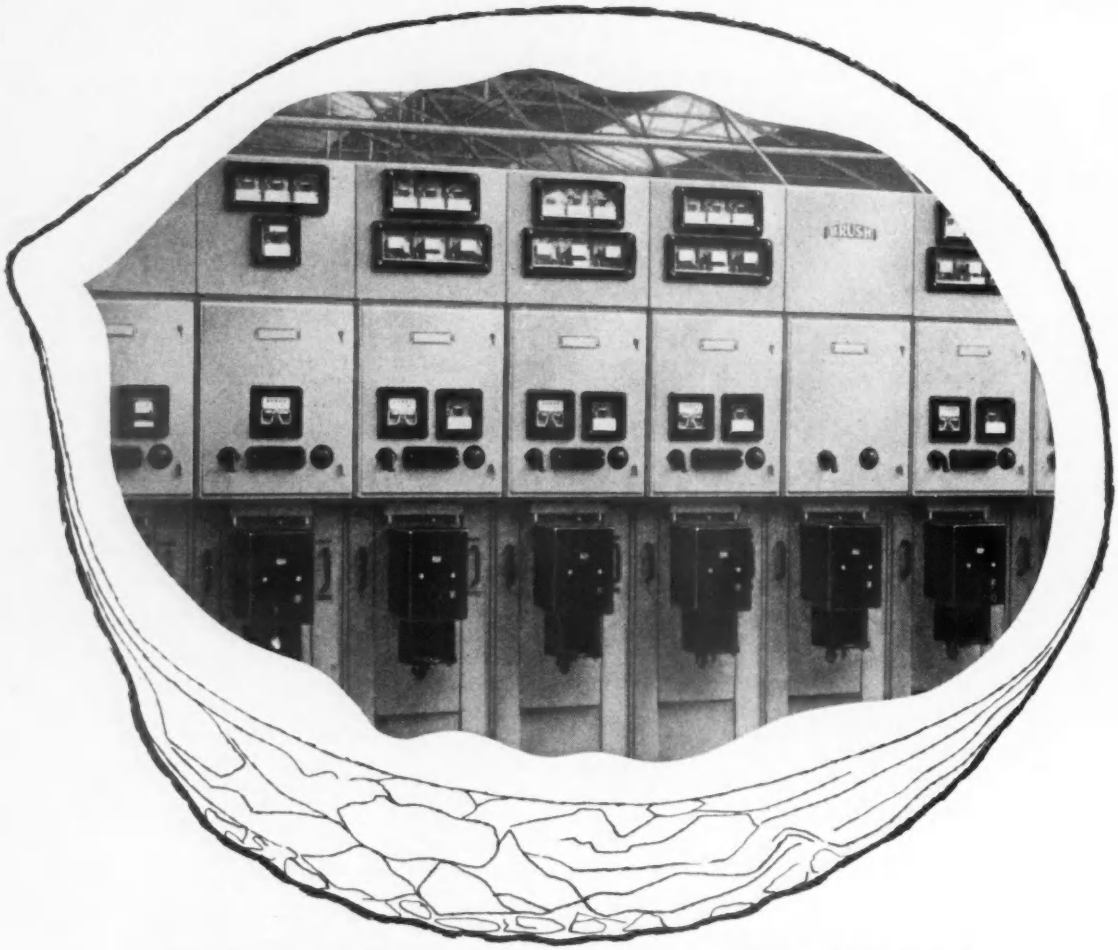

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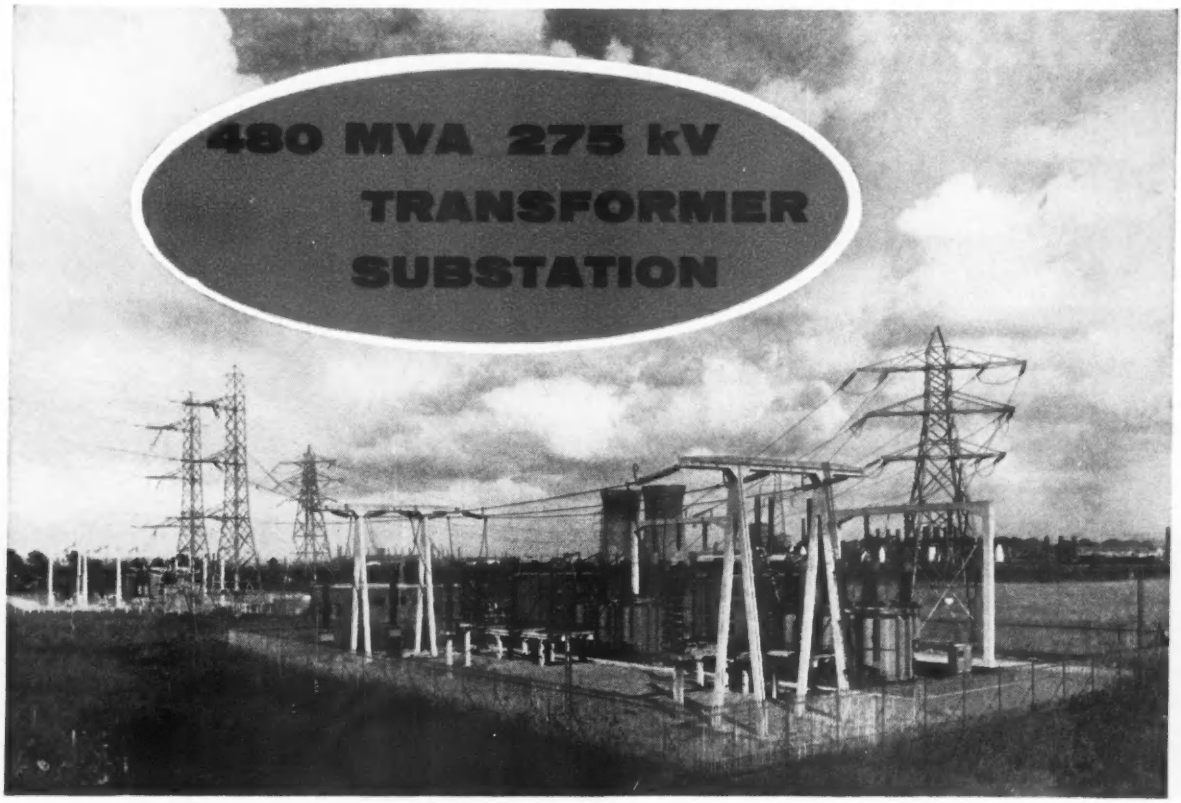

With its four 120 MVA auto-transformers the Clyde's Mill substation of the South of Scotland Electricity Board was the first in Scotland to come into service on the 275 kV grid.

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Four 240 MVA 275/132 kV auto-transformers for the Windyhill and Neilston transmission substations of the South of Scotland Electricity Board.

Two 225 MVA 16/285 kV generator transformers, the largest double-wound transformers so far ordered for Scotland, for the Kincardine-on-Forth power station of the South of Scotland Electricity Board.

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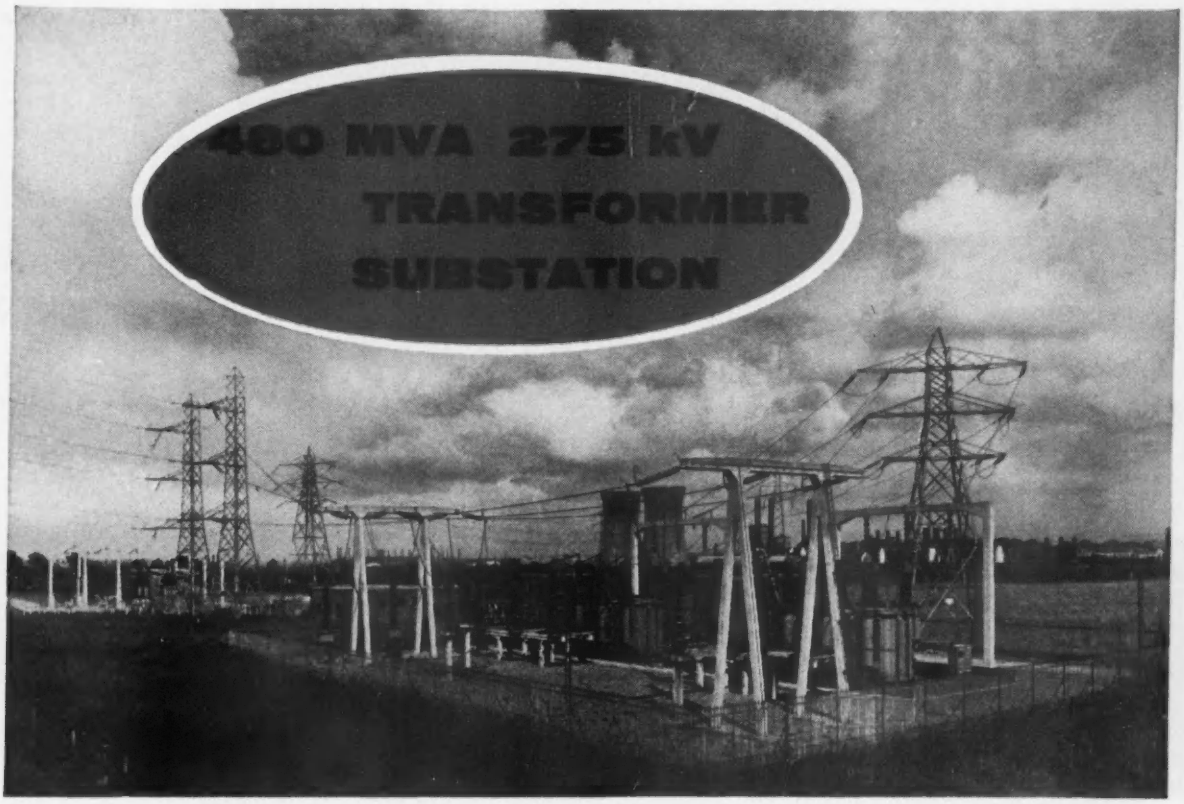

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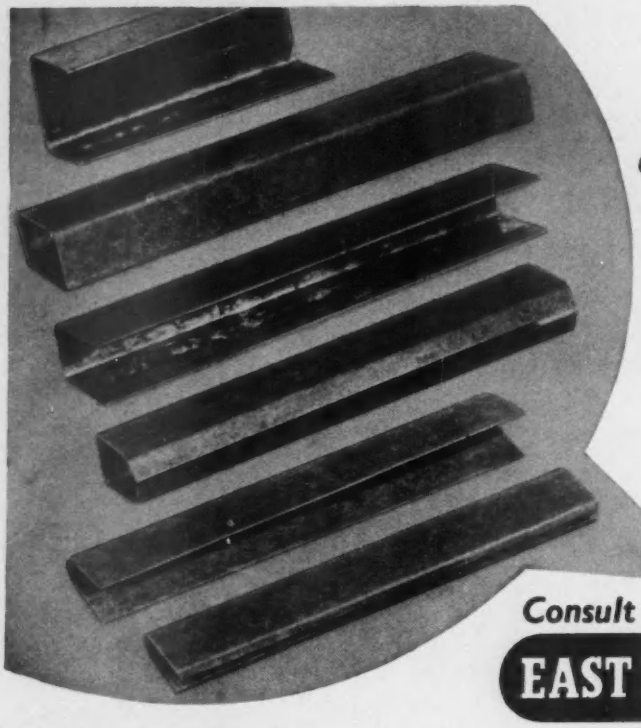

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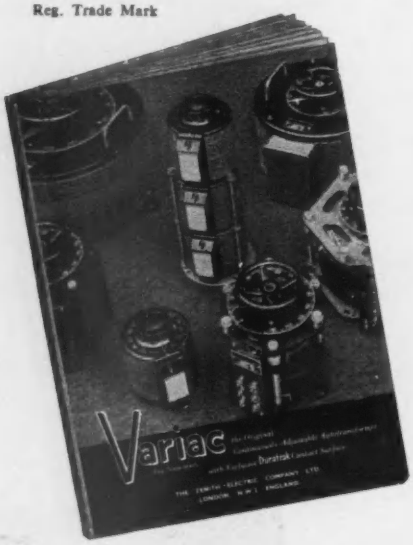

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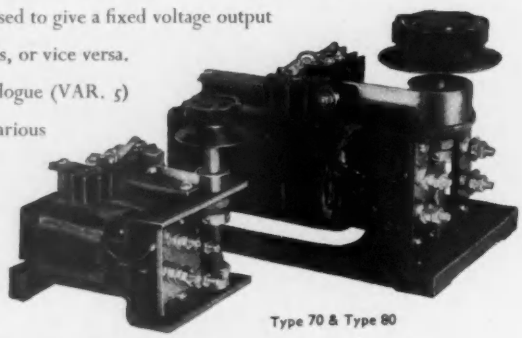

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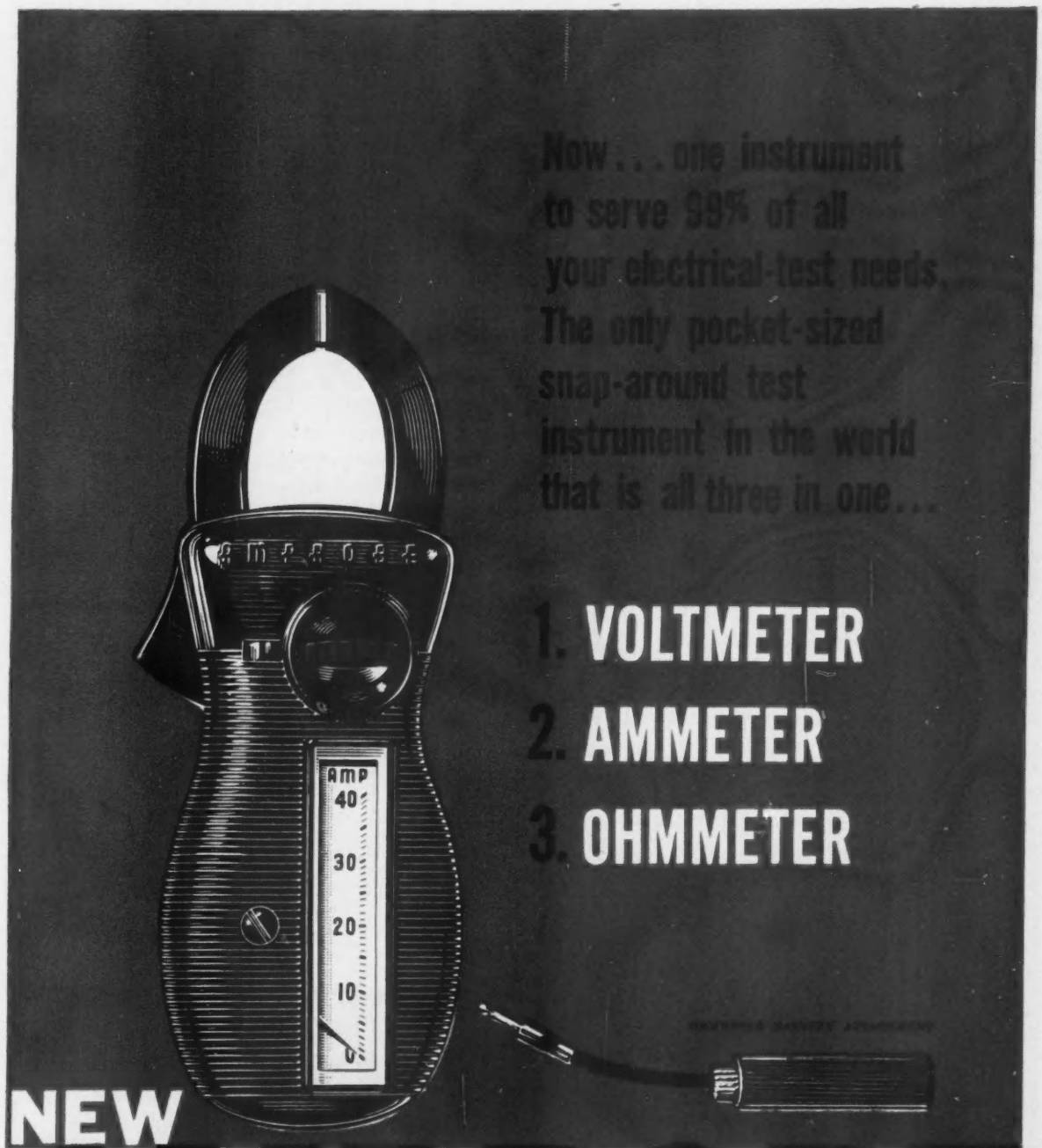

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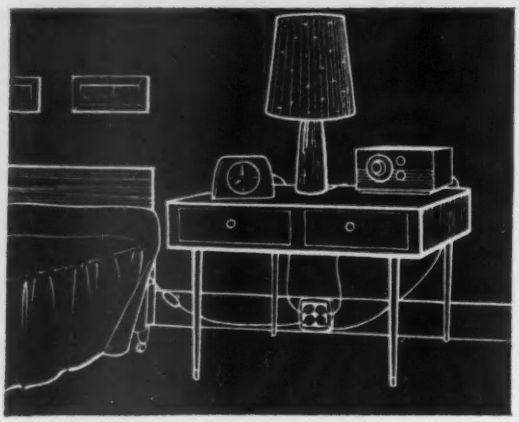

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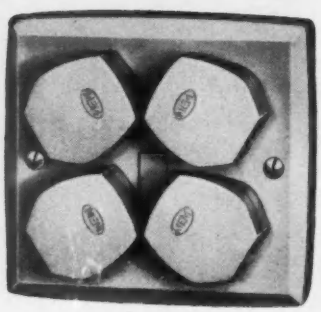

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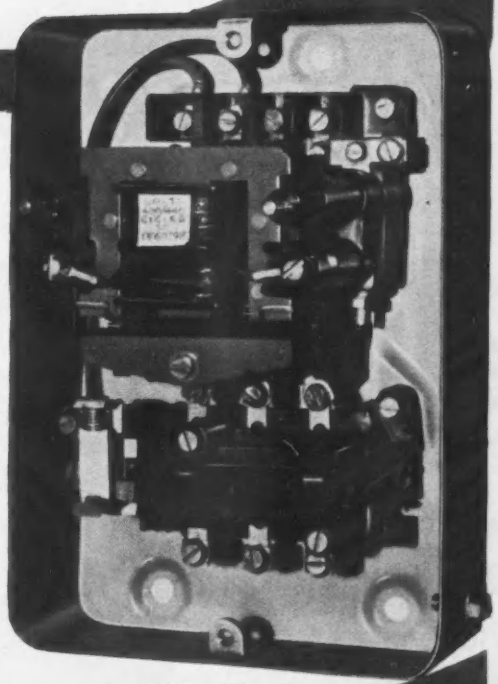

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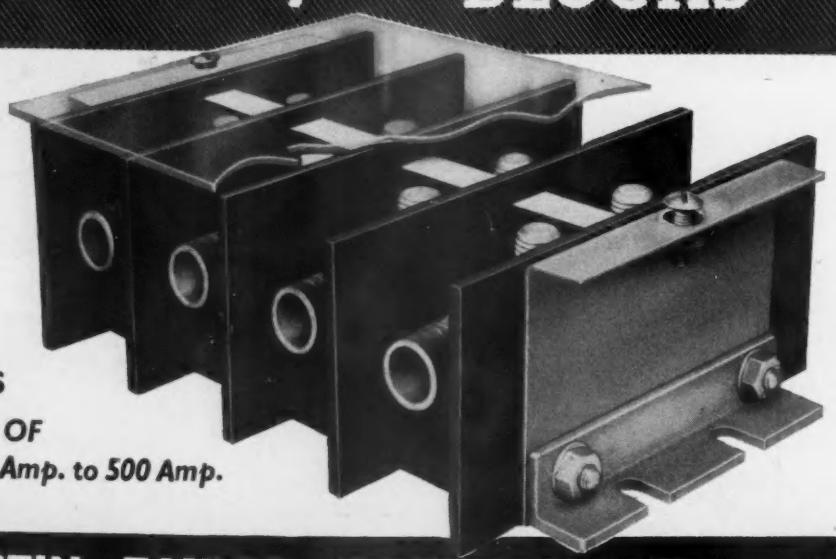

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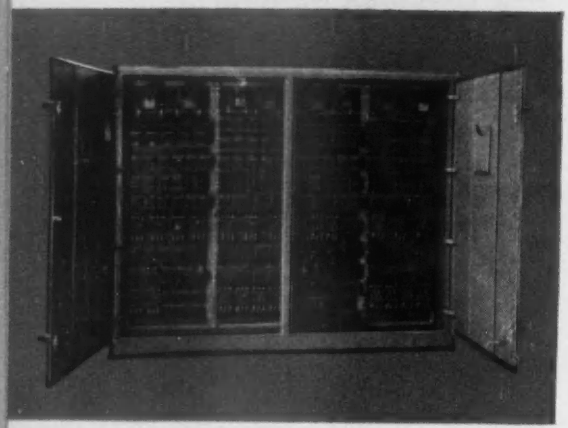

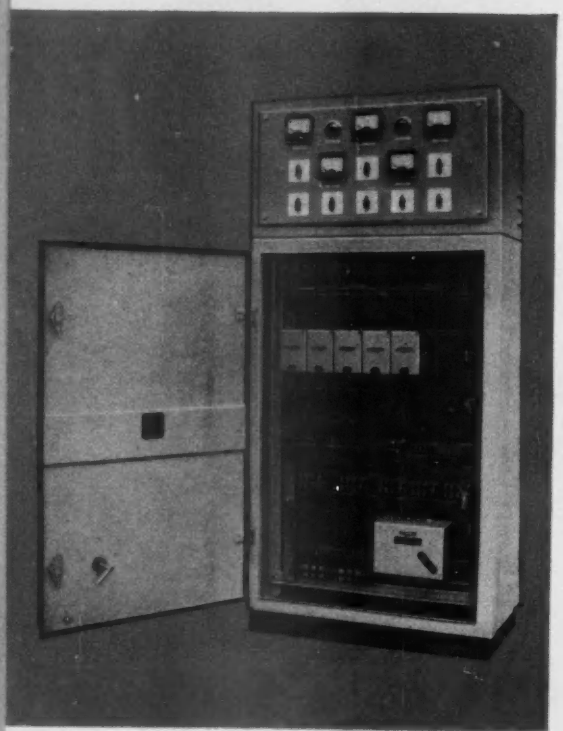

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Control panel for eight-head rotary indexing machine.

Lower left:
Control panel for industrial refrigeration plant.

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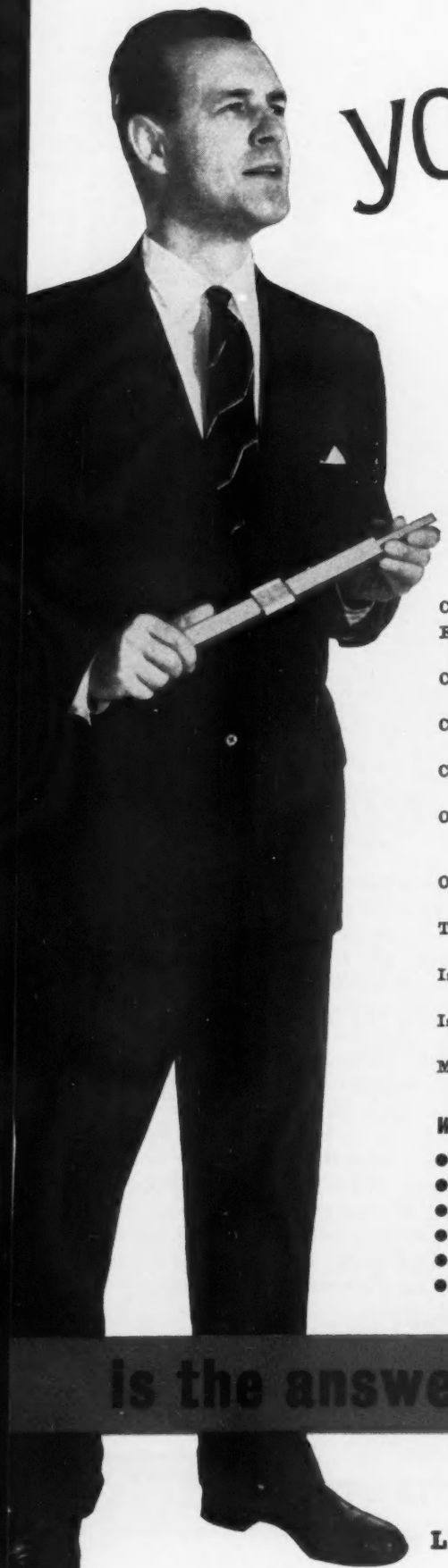

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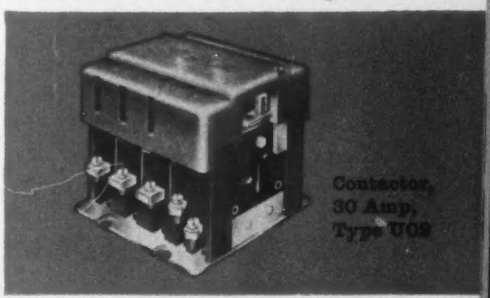
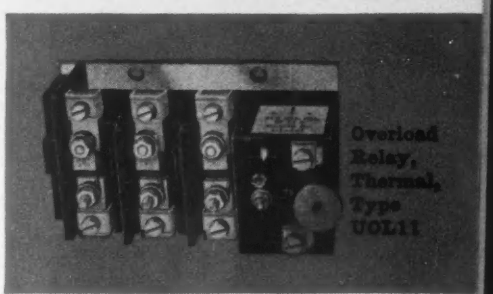
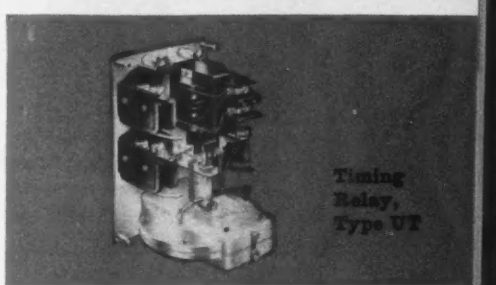


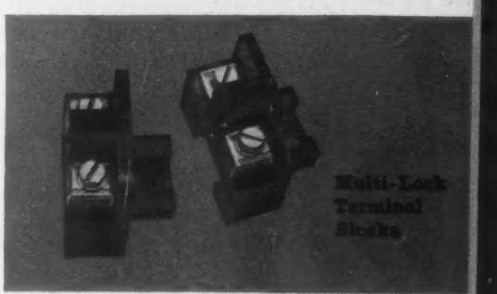
Contactor, 30 Amp, Type UC2



Overload Relay, Thermal, Type UOL11



Timing Relay, Type UT



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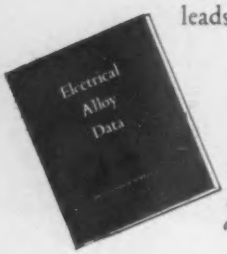

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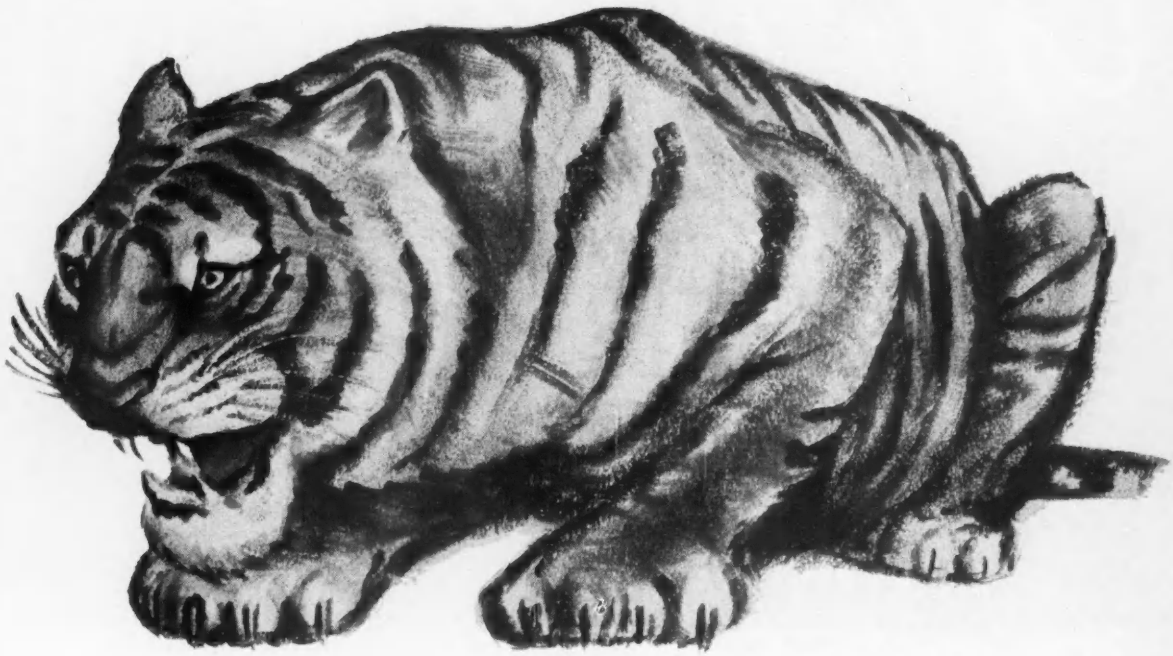

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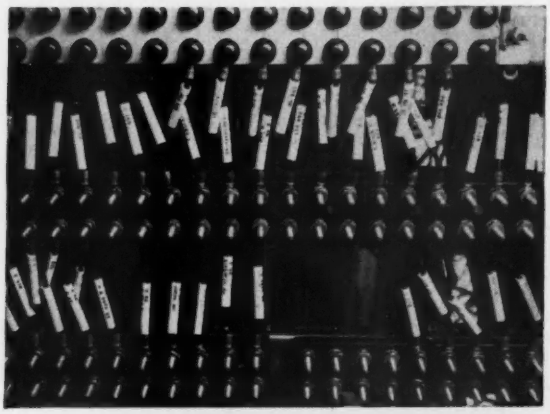
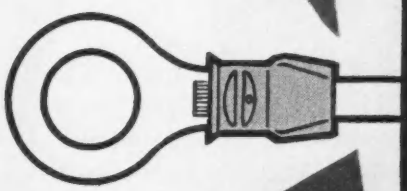
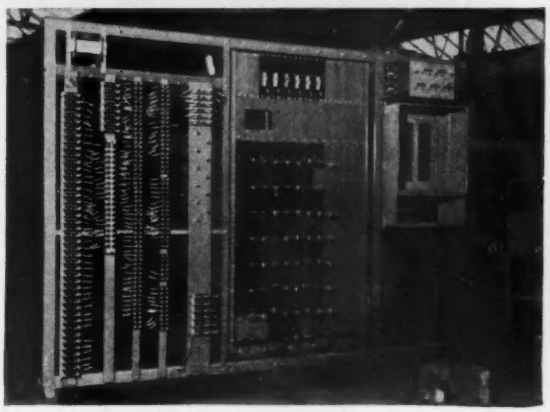


*Close up showing *Plastibond Terminals.*

** Plastibond Terminal*





Relay rack for a C.T.C. system

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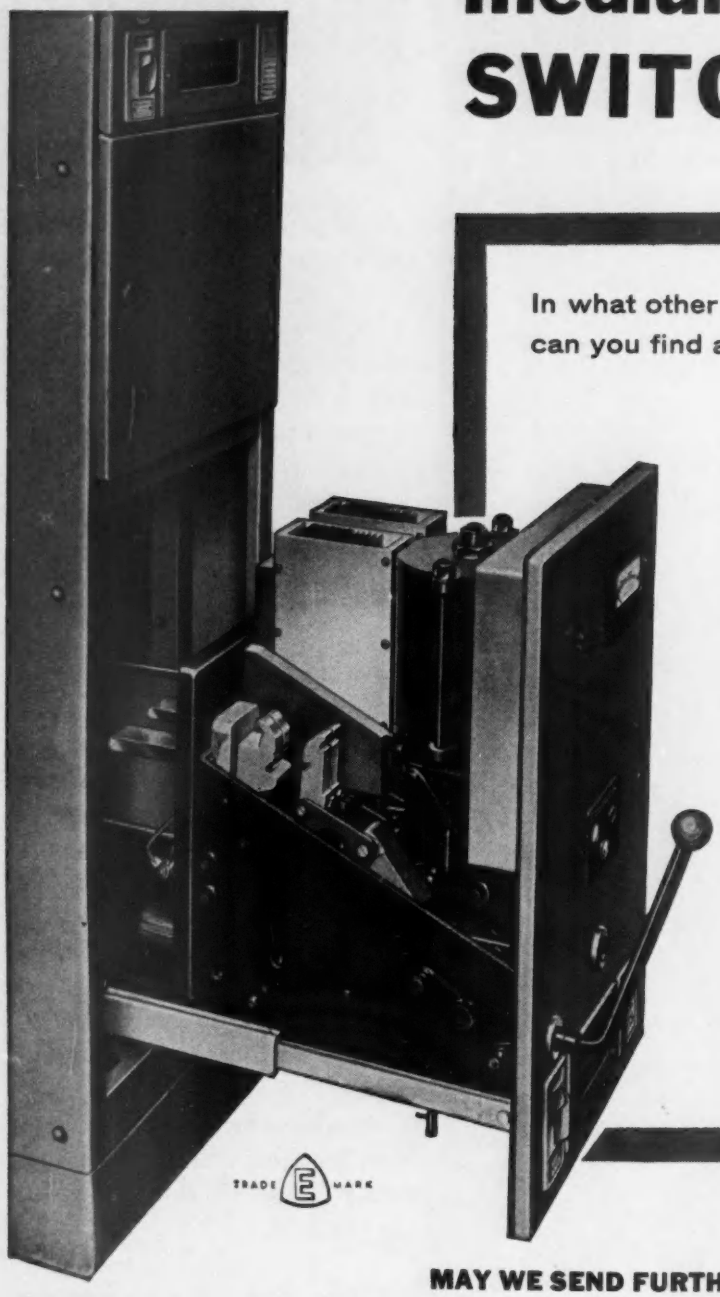

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THURSDAY 6 APRIL, 1961
Registered as a Newspaper Volume 139 No. 14

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Thermionic Generation 545
by J. W. Gardner, B.SC., PH.D., M.I.NUC.E.

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Dans ce numéro

Générateurs thermioniques 545

Les générateurs thermioniques offrent un moyen particulièrement prometteur de transformer directement en électricité la chaleur issue des réacteurs nucléaires. Jusqu'ici, on a obtenu un débit de l'ordre de quelques watts, avec des rendements de conversion atteignant 17%. On estime qu'il doit être possible d'atteindre un rendement de l'ordre de 40%. Avec les générateurs thermioniques, on peut envisager la réalisation de dispositifs à rapport poids/puissance relativement faible, qui conviendraient particulièrement à l'équipement portatif.

Expérience avec une centrale électrique de 600 MW. 551

Une expérience effectuée avec une centrale électrique comprenant six turbo-alternateurs de 100 MW, sans réchauffeurs, a permis de réduire de 3h15 à 1h45 le temps nécessaire à la remise en marche, à plein rendement, d'un groupe donné, après une immobilisation complète de 6 heures. Les turbines utilisées comportent un cylindre à haute pression à double enveloppe qui s'est avéré efficace. Les chaudières n'ont jamais causé d'ennui, sauf en ce qui concerne la déperdition observée à la sortie des tubes de chauffe—déperdition due apparemment à la teneur en sodium et en potassium relativement élevée de la cendre produite par le charbon.

Tunnel aérodynamique à commande et réglage électriques 553

Un tunnel aérodynamique pour l'essai des modèles d'avion à des vitesses aériennes quadruples de celle du son est actionné par deux compresseurs. Chacun de ces derniers est entraîné par un moteur à induction de 10.000 CV et un moteur synchrone de 34.000 CV; le moteur à induction assure le démarrage du moteur synchrone. La section d'essai du tunnel aérodynamique est munie d'une tuyère réglable, formée de plaques d'acier flexibles actionnées par des vérins à vis à commande électrique.

In dieser Nummer

Thermionischer Krafterzeugung 545

Die thermionischer Krafterzeugung erscheint besonders im Zusammenhang mit der direkten Umwandlung der von Kernreaktoren stammenden Wärme in elektrische Energie aussichtsreich. Vorläufig hat der Betrieb bei Temperaturen von ca.2200°C Leistungen von einigen Watt ergeben, wobei der Wirkungsgrad der Umwandlung bis zu 17% betrug. Man nimmt an, dass dieser Wirkungsgrad bis auf 40% verbessert werden kann. Die thermionischer Erzeugung mag sehr wohl zu Vorrichtungen mit vergleichsweise niedrigem Gewicht/Kraft-Verhältnis führen, die in transportablen Anlagen eingesetzt werden können.

Erfahrungen mit einem 600 MW Kraftwerk 551

Erfahrungen, die man beim Betrieb eines Kraftwerkes sammeln konnte, das mit sechs 100 MW Turboalternatoren ohne Wiederaufheizung des Dampfes arbeitet, ergaben, dass die Zeit, in der ein Satz nach sechsstündiger Unterbrechung auf Volleistung gebracht werden kann, von 3½ auf 1½ Stunden reduziert worden war. Die Turbinen besitzen einen doppelwandigen Hochdruckzylinder und diese Massnahme hat zum Erfolg geführt. Die Kessel bereiteten keine Schwierigkeiten, abgesehen vom Verschleiss der Heizröhren an der gasbeaufschlagten Oberfläche; diese Erscheinung hängt offenbar mit dem verhältnismässig grossen Natrium- und Kaligehalt der von der Kohle herrührenden Asche zusammen.

Elektrisch betriebener und gesteuerter Windkanal ... 553

Ein Windkanal für Versuche mit Flugzeugmodellen bei Geschwindigkeiten, die viermal höher als die Schallgeschwindigkeit liegen, wurde mit zwei Kompressoren ausgestattet. Jeder dieser Kompressoren wird von einem 10 000 PS Induktionsmotor sowie einer 34 000 PS Synchronmaschine angetrieben, wobei der Induktionsmotor dazu verwendet wird, die Synchronmaschine auf volle Geschwindigkeit zu beschleunigen. Im Versuchsteil ist der Kanal mit einer veränderlichen Düse versehen. Die Düse umfasst biegsame Stahlplatten, die von elektromotorisch betriebenen Stellschrauben betätigt werden.

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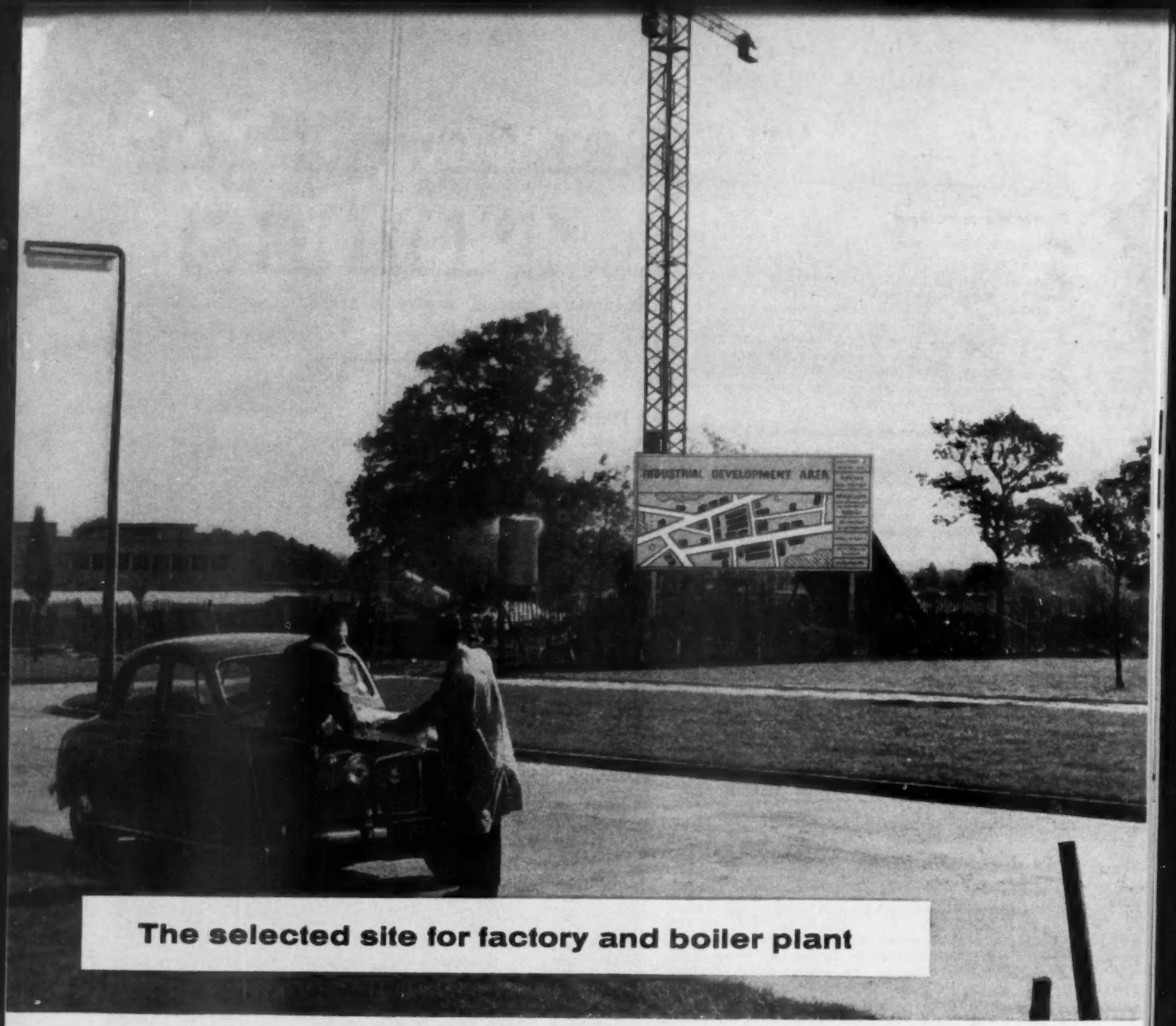

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 6 APRIL, 1961

Editor and Managing Director:
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News Editor:
T. W. WRIGHT

Comment

WIND OF TARIFF CHANGE

Ten area boards have raised tariffs in the last six months, and the remaining two have announced their intention of doing likewise. Not all ten boards have raised all tariffs; some have been content with the automatic increase from the coal cost adjustment in m.d. two-part tariffs, but all domestic tariffs have been raised. Some increases have been in the rate per unit only, others have applied to the units per block as well. This exercise in price-raising has underlined once more the individual thinking of the now-autonomous boards, and while the pattern of prices per unit nearly follows the Severn-Wash division, the complex obscurity of block tariffs conceal a truly heterogeneous display of fixed charges. Based on an average house of five rooms or 1,200 sq ft, equivalent fixed charges may vary from 18s 1½d to 32s 1d, or even up to 41s 11d if one ignores the average consumption per consumer in the calculation. Can the economic factors on which such tariffs are presumably based vary to such an extent? The growing popularity of the three-block tariff complicates the problem, particularly as in policy there are two variants. The tariff with a moderate second block of medium-priced units has the advantage of flexibility; prices can be raised without it being too obvious to the consumer. The other has a more promotional character, with a low price for a large second block, larger than the average consumption per consumer, with a final rate specially fixed for the large domestic user. Such factors suggest that the time is opportune for a new basic study of the economic factors involved in such tariffs, and the Electricity Council might well initiate a special comprehensive investigation to parallel that which the CEGB is undertaking on bulk supply costs.

SAFER AT HOME

1960 was a relatively good year from the aspect of electrical accidents at home. The preliminary figures issued by the Home Office show that there was a drop of almost one-half on the 1959 totals for deaths from electrical causes, the total of 38 known deaths being the lowest for some years. Thirty-eight lives lost is not a statistic to be regarded complacently, of course, even if the fall in number from the 78 deaths of 1959 is more than a fluke of time distribution. But the drop is welcome, the more so since last year saw such heavy use of electricity at home. Unhappily, the industrial accident returns do not reinforce the cheerfulness of the domestic figures. They show an increase in number of deaths from 73 to 85, and of the total fatalities, 31 are attributable to live rails and overhead cables on railways and similar installations, and to supply overhead lines. Somehow, 11

children became involved in accidents of this kind and lost their lives. Figures like these stress the need for continued vigilance, and perhaps some new thinking about prevention. Overall, however, the statistics demonstrate that the electrical industry is improving its safety record at a rate at least as great as its consumers are increasing the use they make of electrical energy—twice as safe every ten years. That seems an argument for leaving the industry to continue its own good work in this field, whatever legislation on consumer protection may come onto the statute book. There is within the electrical industry sufficient diversification of interest to guard against dangerous complacency.

TEST OF EXPERIENCE

Such has been the rate of advance in power plant design, that 100 MW straight cycle sets now seem small beer. Yet it is only five years ago that the six-set Castle Donington station commissioned its first machine at this rating, and could claim, in the words of a paper presented to the Institution of Mechanical Engineers, to be "the first post-war project to embody new developments on a large scale . . . a major step forward in generation technique." The paper is particularly valuable as a record of the success of those techniques, measured against the intentions of the designers. It is useful to look at what was involved, and what the judgments of experience are. In overall station design philosophy, Castle Donington represented an attempt to obtain with larger sets, the full advantages of unit operation and of strict standardisation of generating unit arrangements. From gas ducts at the back end of the boilers, across the station to transformer h.v. connections, each unit fully duplicates its neighbour. This approach facilitated design and drawing office work and construction, and continues to give advantage in operation and maintenance. In plant details, the boilers represented a jump ahead in mill size and some tubing details; and the turbines represented the first British double-shell h.p. cylinders and tight-coupled three-bearing rotors. Both solutions have proved successful, and have been extended to succeeding, larger, sets. Experience in operating the station has broadly confirmed the correctness of the design decisions it incorporates, although it has, of course, brought new ideas for future application, particularly in relation to the two-shift operation which British coal-fired stations will all have to match in a nuclear-energy future. The two problems of quick starting of sets after one-shift shut-down, and of achieving good boiler availability with poor coal are both prominent here.

IDENTIFICATION UNDERGROUND

One of the disadvantages of plastics is that their very virtuosity brings complications. This arises particularly where there are runs of piping in p.v.c. or polythene, something with which electrical engineers are much concerned. Whether the plastic is insulating a power cable or protecting its armouring, carrying water and so depriving the electrical engineer of a good earth, covering the screen of a telephone cable, or providing a duct for some mundane purpose, it is liable to look the same. This presents difficulty when identification is needed, and difficulty introduces danger. It is brought to mind by an amendment to a National Coal Board purchasing specification, which we note this week, which has required that all cables with p.v.c. over the armouring—black p.v.c. is specified—shall have the words "electric cable" and an indication of the voltage embossed in raised letters. How far is this practice to spread; and is it the correct answer to the problem? It seems that a better answer for overall use might be colour coding, well enough recognised in terms of pipework. Electrical orange is not confusing with any of the functional colours used in this country for circuit identification—should a move be made now to have this the standard colour for cables having outer plastics sheaths? It seems probable that the chemist comes into the question, for dull colours may well have attractions from the ageing viewpoint; but identification there will have to be in the long run, and there is certainly much to be said in favour of using colours rather than lettering.

ENGINEERS FOR EDUCATION

If the Government's plans for expanding technical college education are to be matched by achievement, 800 electrical engineers, broadly of professional level, must be found during the next two years, willing to become technical teachers. And once these engineers decide that they have a vocation for this work, and that its rewards are sufficient for their ambition, they have to be converted from active engineers to teachers of engineering. An article on a later page describes the latter operation from the aspect of technical teacher training colleges, a relatively late arrival on the British educational scene, but one that is expanding fast under the realisation that there is a technique to teaching which can ease the effort and increase the effectiveness of the job. For technical teachers, too, the task is different from that facing their colleagues dealing with younger people. Training colleges, it is to be noted, take only qualified and experienced engineers as students, and it must be hoped that this requirement will not be relaxed under the stress of rapid expansion. Although so much of engineering education today is concerned with inculcating the theory that may make sense of the developments of a decade ahead, if the teacher has been an engineer, he is likely to impart the feel of engineering problems more readily than the man who has made the transition from learning to teaching directly, without experience of the world in which his pupils will have to exist.

Meteor

This week's quick summary of electrical news faces advertisement page 16

Thermionic generation

DIRECT HEAT-ELECTRIC ENERGY CONVERSION

by J. W. Gardner,* B.Sc., Ph.D., M.I.Nuc.E.

THERE are limits to the efficiency of electricity generation which may be attained with conventional techniques, which interpose a heat engine between heat liberation and electricity generation. In an attempt to overcome these limits, and reduce capital and maintenance costs, attention is being given to methods of direct conversion.[1,2] Four methods seem particularly promising; magnetohydrodynamics conversion (separation of positive and negative charges in a gas); thermoelectric conversion (principle of thermocouple); thermionic conversion (principle of radio diode); and fuel cells (separation of positive and negative charges during a chemical reaction).

The first two of these proposals have already been described in the ELECTRICAL TIMES[3,4]; it is the purpose of the present article to discuss the third. A short statement of the basic physical principles of the thermionic converter is followed by an account of the various means devised to improve its efficiency, and which have made possible working generators on a laboratory scale. The article concludes with an outline of some of the major technological difficulties besetting the exploitation of thermionic generation on an industrial scale.

It should be stressed that the four proposals noted above, although the most promising of many, all still require a great deal of technological development before they become competitive large-scale power producers. Nevertheless, their future potential is not subject to the above-mentioned overriding limitations of conventional generators, and this alone makes them worth developing.

Thermionic Fundamentals

The ordinary radio valve operates on the oldest principle known in electronics, discovered accidentally by Thomas Edison in 1883. At one stage in his manufacturing of light bulbs, Edison had two independent filaments in each bulb, only one filament being connected at a time. When the first filament burned out, the bulb was turned around in its socket, connecting the spare filament. In testing these bulbs, Edison discovered that a small current could be drawn from the filament that was not connected: evidently some electricity was moving through the vacuum in the bulb from the hot filament to the cold.

In fact, the bulb was acting as a diode valve in which application of heat to the cathode "boils off" electrons from its surface; these electrons then flow to the anode and around the external circuit, constituting an electric current (see Fig. 1). Clearly, such a valve is acting as a direct conversion device, converting the heat applied to the cathode into an electric output at the anode. However, as a practical thermal-to-electric power converter, the typical radio diode is hopelessly inefficient: for an output of a microwatt (say a microampere at a volt) the input power required for cathode heating could be 10 W, representing an efficiency of 0·00001%.

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In order to understand the reasons for this extremely low efficiency, and the steps taken to improve on it in thermionic power converters, it is necessary to examine in a little more detail just what goes on inside the diode valve.

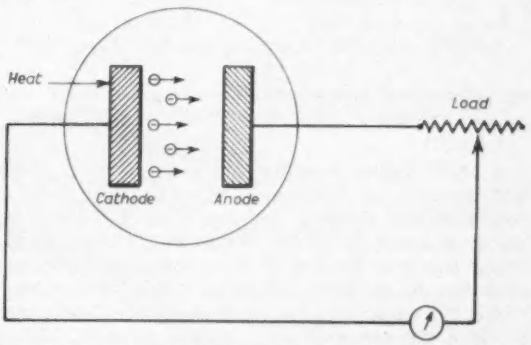

Fig. 1. Basic principle of thermionic generation. Electrons are "boiled off" from the surface of the cathode

In metals and other good conductors, electric current is carried by free electrons, unattached to atoms. There are about 10^{23} such electrons in a cubic inch of a good metallic conductor, and even when no macroscopic current is flowing they have random jostling motions which increase with temperature. If a plate of conductive material (the cathode) is heated these random electronic motions increase in violence until some electrons acquire sufficient energy to overcome the potential barrier at the cathode surface, then they are ejected into the vacuum. This is the well-known phenomenon of thermionic emission; the emission current increases very steeply with cathode temperature.†

A semi-quantitative picture of the fate of the ejected electrons is offered by Fig. 2(a). The potential inside the cathode material is taken as zero and the surface potential barrier—called the work function—is represented by V. As the cathode is heated, electrons with energies greater than V escape into the space between cathode and anode. When an electron reaches the anode it falls down the potential barrier corresponding to the anode work function v. The energy thus released is converted back into heat at the anode; however, if the anode work function is less than that of the cathode there remains an amount of energy V-v, which is available to do useful external work and supply the electrical losses in the return circuit.

The above description has been over-simplified by neglecting both the space charge effect and the back

† Although the discovery of thermionic emission is attributed to Edison, and the phenomenon often called the "Edison effect," it was first systematically investigated by the late Professor Owen Richardson, whose famous law relates the emission current density to temperature, work function, etc.

emission of electrons from the anode surface. The most obvious way of preventing the latter is to keep the anode cool, although there may be practical difficulties about this, which will be discussed in the next section.

The space charge effect is due to the mutual repulsion of electrons: an electron emerging from the cathode finds itself in the company of a swarm of other electrons, all similarly charged, by which it is repelled. This repulsion will drive most of the electrons back into the cathode before they have a chance to reach the anode.

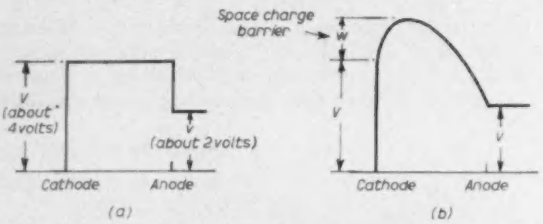

Fig. 2. Quantitative representation of fate of electrons leaving cathode; (a) simplified, (b) taking account of effect of space charge

A more realistic potential energy diagram for a diode with space charge is offered by Fig. 2(b), from which it is clear that only electrons emerging from the cathode with energy at least (V+W) will be able to surmount the space charge barrier and reach the anode. Owing to the statistical spread in the energies of electrons leaving the cathode we would still expect *some* of them to have sufficient energy to reach the anode; these in general, however, will constitute only a minute proportion of the total number of electrons emitted. Evidently, then, the anode current is going to be severely limited by space charge—which is the main reason for the very low efficiency of the ordinary diode.

Efficiency Requirements

We are now in a position to list the principal desiderata for high efficiency and output of a thermionic converter. They are:

1. The cathode temperature should be high;
2. The cathode work function (V) should be high (within limits‡);
3. The anode temperature should be low;
4. The anode work function (v) should be low;
5. The space charge should be removed or neutralised.

Naturally, the above criteria are not mutually independent, so that some compromise will be sought in constructing a practical converter. For example, making the cathode hot tends also to make the anode hot, since it will receive heat by radiation from the cathode; or, again, the method used to reduce space charge may affect the electrode work functions.[6]

Current research on cathode materials,[5,7] is directed towards combining a high work function with the ability to withstand high temperatures (up to 4,000°F) without excessive evaporation, melting, or other mechanical deterioration. The critical evaporation rate is usually taken to be a thickness of 0·05 in. of material in 1,000 hr at the operating temperature: anything which evaporates faster than this is not acceptable as a cathode material.

For anode materials the problem is to combine a low work function with high reflectivity for infra-red radiation. The latter characteristic is necessary in order to prevent excessive anode heating by radiation from the cathode, and so minimise back emission. Typical anode working temperatures are 1,000°F to 1,500°F.

Tables 1 and 2 list the properties of some characteristic electrode materials. The figures in the tables are necessarily imprecise, since the condition of an electrode surface (and hence its work function) will be influenced by the amount and type of use it has received.[5]

Table 1. Cathode Material Characteristics

Cathode Material	Work Function V (Volts)	Temp. Range (°F)
Barium-impregnated Tungsten	1·7	1600-2200
Thorium on Tungsten ...	2·55	3200-3600
Caesium on Tungsten ...	1·7	2500-2900

Table 2. Anode Material Characteristics

Anode Material	Work Function v (Volts)
Barium Oxide/Strontium Oxide on Nickel	1·0
Caesium on Silver Oxide	0·75
Caesium on Tungsten Oxide	0·71

Space Charge Removal

The biggest single factor limiting the efficiency of the diode converter is undoubtedly the space charge effect, and it is hardly surprising, therefore, that a considerable number of ingenious proposals have been made for its removal. Those which have received serious consideration to date are as follows:[9,10]

1. Short interelectrode distance;
2. High electron velocity;
3. "Ball-of-fire" discharge;
4. Plasmatron principle;
5. Resonance ionisation;
6. Ionisation by fission fragments.

Methods 1 to 5 are considered briefly in this section; method 6, which is limited to converters in nuclear reactors, is more appropriately left for later discussion.

A quantitative analysis of a diode in which the electrodes are close-spaced similar planes was published in 1957 by Moss,[11] who showed that for reasonable performance an interelectrode space of 0·0005 in. or less is required. At the time that study was made, it was felt to be virtually impossible to maintain such a spacing accurately over an appreciable area, particularly at high temperatures. Such is the rate of progress in this field, however, that within little more than a year, diodes of this spacing and less had been successfully built and demonstrated in the laboratories of the Massachusetts Institute of Technology and the Thermo Electron Engineering Corporation;[12] and by the end of 1960 the American General Electric Company was marketing a small (1 W) diode converter using this spacing.[13] It now appears that the ultimate limit to the close-spaced diode may be set by another consideration, namely, the difficulty of maintaining the lower anode work function in the presence of the evaporant stream from the emitter.[14]

The second method is based on the principle of magnetron operation under cut-off conditions. Fig. 3 depicts an embodiment of the device having the cathode and anode side by side, and opposite to an accelerating electrode. A high voltage applied to the accelerating electrode imparts high velocities to the electrons which are,

‡ A full mathematical treatment,[5] beyond the scope of this paper, shows that the efficiency does not increase indefinitely as V is increased, but reaches a maximum for some value V′, and thereafter falls off for still higher values of V. Thus there is no point in choosing a cathode material with work function exceeding V′; the anode work function, on the other hand, should always be as low as possible.

however, forced to move to the anode by the perpendicular magnetic field. The high voltage source and magnetic field represent some power wastage, which, in fact, becomes prohibitive at the high emission current densities necessary for the efficient operation of a diode power converter.

The remaining methods all employ positive ions in the interelectrode space to neutralise the negative space charge. The "ball-of-fire" method is so called because the cathode is operated in an arc mode, creating a small region of high potential in the interelectrode space. Ions formed in this region neutralise the negative space charge in the surrounding dark plasma, An electrode potential exceeding the ionisation potential of the gas is required for starting the discharge. Calculation shows that this is a rather inefficient process for ion generation.[9]

The efficiency of ion generation is higher by a factor of at least two in the plasmatron mode of operation,[11] in which ions are injected from an auxiliary discharge. The power needed for this auxiliary discharge is about 1W/A of main discharge current, and could, in principle, be taken from the output of the converter.

The phenomenon of "resonance ionisation" can occur when a gas whose ionisation potential is lower than the cathode work function is introduced into the tube. When this condition is satisfied, neutral atoms striking the hot cathode will be ionised and injected as positive ions into the interelectrode space. In this way, a plasma extending from cathode to anode is formed. For complete neutralisation, the ion density must equal the electron density, and this requirement enables the necessary gas pressure to be calculated. Naturally, this depends on the operating temperature and current density, but it could be around 0·0001 millimetre of mercury in a typical case. In this type of diode caesium (ionisation potential of 3·89 V) is usually employed as the gas, and tungsten (work function 4·52 V) as the cathode, although other cathode materials are under active investigation.[7,15] The high work function required for the emitter surface necessitates the use of very high temperatures (3500°F upwards) in order to obtain the desired electron emission flux. Because of the limited combustion temperatures and inevitable convective temperature drops associated with the use of fossil fuels, it seems likely that the best results with caesium diodes will be obtained with nuclear fuels and perhaps, ultimately, solar radiation.

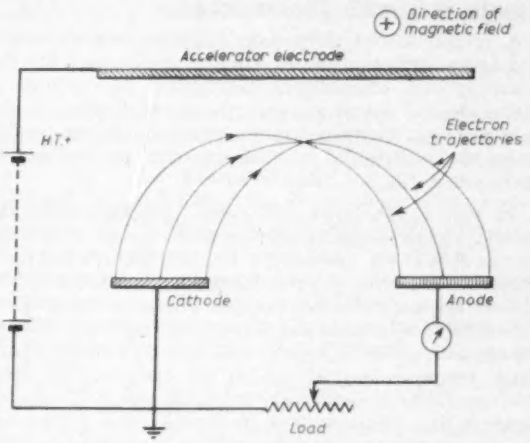

Fig. 3. Use of magnetron principle for thermionic generation

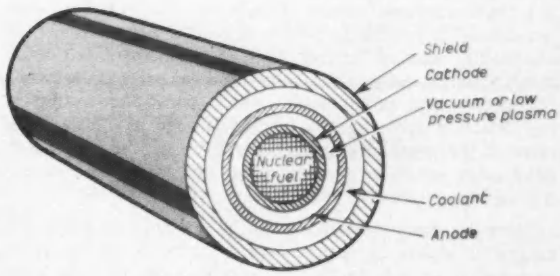

Fig. 4. Plasma dicde construction for operation in nuclear reactor

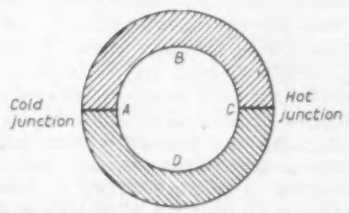

Fig. 5. Thermionic diode considered as a thermocouple

Nuclear Applications

In a nuclear reactor, the intrinsic temperature of the fissioning process itself is millions of degrees—the temperature of the fire ball in an atomic explosion—but the practical operating temperature is dictated by the melting point of the fuel rods, which have to be deliberately cooled. Today's nuclear power stations do not capitalise on the truly unique nature of atomic energy itself, but use it rather as alternative heat source with which to boil water, raise steam and drive conventional turbo-generators.

The first direct conversion into electricity of the heat from nuclear fission was achieved by means of a plasma diode operating in a nuclear reactor, at the Los Alamos Laboratories early in 1959. The diode is represented schematically in Fig. 4; the central nuclear fuel rod was constituted of a solid solution of zirconium carbide/uranium carbide, and operated at a temperature of around 4,000°F. A matched-load power output of about 30 W was obtained (and used to light a small electric bulb for the benefit of reporters!). The highest conversion efficiency reported at that time was 15%, but it has since been increased to 17% and ultimate efficiencies in the region of 40% have been predicted.[15]

The development of a similar device has recently been reported by General Atomics; this has delivered 90 W into an external load, at a power density of about 100 W/sq in. In this case, at the cathode operating temperature of 3,500°F, an efficiency of 10% was achieved for the conversion of fission heat into electrical energy, but no attempt was made to utilise heat rejected by the converter or the efficiency and output would have been higher.[16]

The plasma diodes which have so far been used in reactors have all employed the resonance ionisation method, with caesium gas, to neutralise the space charge. Another method which has been proposed (No. 6 in the list of the previous section) is to allow the fission fragments from the uranium-bearing cathode to produce ionisation in the low-pressure gas, which would probably be argon in this case. The use of a noble gas rather than caesium in a nuclear heat converter has the advantage of providing a plasma gas which can be more readily handled and circulated, and out of which gaseous fission products can be extracted to provide for longer reactor lifetime. Experiments are in progress to test this mode of plasma generation, which looks theoretically promising.[16]

Comparison with Thermocouple

A comparison of thermionic and thermoelectric direct conversion devices discloses some of the reasons for the relatively high efficiency of the former. An account of thermoelectric converters has already been given in the previous paper by the present author;[4] however, for present purposes it will suffice to recall the basic phenomenon of thermoelectricity.

In Fig. 5, the loops ABC, ADC represent dissimilar metals; an electric current can be made to flow around the circuit ABCD by maintaining the junctions A and C at different temperatures. The thermoelectric voltage which drives this current is directly proportional to the temperature difference between the hot and cold junctions. Because metals are excellent conductors of heat, they do not sustain large temperature gradients, so the voltage from metal thermocouples is always very small. Of course, if the metal loops in Fig. 5 were replaced by thermally insulating loops, a large temperature gradient could be maintained between A and C; but the common thermally insulating materials are also electrical insulators, so that no current could flow in a "thermocouple" made of such materials. Ideally, what is required is something which is both a perfect electrical conductor and a perfect thermal insulator. No such ideal material exists, but some modern materials (semiconductors and semimetals§) which constitute a step in this direction are currently being exploited in the development of thermoelectric generators. Even so, the conversion efficiencies of these generators do not at present exceed 5% or 6%.

Now the thermionic diode can be regarded as a thermocouple in which the cathode corresponds to the hot junction and the anode to the cold junction; the interelectrode space then corresponds to the thermoelectric material of one of the loops in Fig. 5. (The other loop is, of course, the external load circuit). The space between the electrodes can, as we have seen, be made an excellent electrical conductor by neutralising the space charge in one or other of the ways described above. On the other hand, the gas pressure between the electrodes is so low that virtually no heat is conducted between them. Thus, the only heat-flow from cathode to anode (from hot to cold junction in the thermoelectric analogy) is by radiation, and this can be effectively reduced by proper shielding. In principle, some heat could also be transferred via the external load, but in practice this is negligible. In other words, the interelectrode space approximates closely to the ideal thermoelectric material, and for this reason one would expect higher efficiencies to be obtainable from a thermionic unit than from a thermocouple using solid thermoelectric materials. In fact, as we have seen above, conversion efficiencies of at least 17% have already been achieved with the thermionic unit.

Of course, it must be borne in mind that the thermionic units giving these relatively high efficiencies require cathode temperatures in the 3,000°F to 4,000°F range, which virtually limits their application to nuclear reactors. It is a fortunate circumstance that materials suitable for electrodes at these temperatures retain their properties reasonably well under intensive nuclear irradiation; moreover, the gamma radiation present in a reactor helps reduce the interelectrode space charge by contributing to the plasma ionisation.

§ The properties of semiconductors were summarised in reference 4. Very crudely, a semiconductor is half-way between a metal and an insulator; a semimetal is half-way between a metal and a semiconductor.

Present-day thermoelectric materials are not suitable for use in nuclear reactors. However, the relatively high outlet temperature (1,000°F to 2,000°F) of the thermionic converter suggests the possibility of a tandem generator in which a thermionic unit rejects its anode heat to the input of a thermoelectric generator located outside the reactor, where it would be shielded from radiation. This point is discussed later.

Present Status and Outlook

The extreme temperatures required for the more efficient thermionic converters militate against their use with fossil fuels, and it appears, therefore, that their development for large-scale power generation will be in conjunction with nuclear fuels. The present status of the plasma diode as a direct converter of nuclear heat is indicated by the outputs and efficiencies quoted above: a few watts output at a conversion efficiency around 15%. Moreover, such performances, for experimental reasons, were maintained for only a few hours at a stretch. Nevertheless, the tests were significant in that they showed the converter to be capable of producing electric power at high current densities and adequate voltages within an actual reactor environment.

Optimisation of dimensions and temperatures, and development of materials suitable for continuous operation at these extreme temperatures are all problems which must be solved before the plasma diode can be considered as a competitive commercial power generator. The materials problems are particularly difficult, not only because of the high cathode temperature but also because of the corrosive nature of the caesium gas, and for this reason alternative methods of plasma generation (e.g., by fission fragments) are under active consideration. In the search for suitable cathode materials, tungsten and tantalum metals have received most attention to date, but a substantial number of refractory compounds such as carbides and nitrides are now being investigated.[15] Even when long-lived cathodes have been successfully developed, serious materials problems will remain in connection with structural parts, particularly corrosion-resistant vacuum seals.

The great advantage of the plasma diode as a converter of nuclear heat is its simplicity: the fuel rod itself acts as the cathode, the can acts as the anode and very little else in involved (Fig. 4). Moreover, because of the relatively high anode temperature, the heat rejected to the reactor coolant would be readily available for steam raising in the usual way for a turbo-generator. It has also been suggested that waste heat from the thermionic generator could be utilised by incorporating a thermoelectric generator in the coolant loop.[7] Overall thermal efficiencies in the region of 50% to 60% have been estimated for such "cascaded" generators.[2] The successful development of these devices would evidently require a merger of electronics and reactor technology.

Like the other direct conversion devices mentioned at the beginning of this article, the thermionic generator is basically a low voltage, high current, d.c. source; a high power unit, for example, may deliver 1,000 A at 1 V. General methods for conversion to a.c. were summarised in reference 4. In the case of the thermionic unit, however, another method is available which exploits the possibility of current modulation within the unit itself: since this is essentially a vacuum or gas discharge tube, modulation techniques known in these fields may be used. One such method is modulation of the electron current by means of a grid between cathode and anode. In another method the electron flow can be switched between several collectors by application of very weak external magnetic fields. Again, in converters where plasma synthesis is used.

the electron current can be modulated by modulating the ion injection.

Throughout this paper the emphasis has been on thermionic generators for large-scale commercial power. It is worth remarking, in conclusion, that much of the current support for work on direct conversion devices, particularly in the USA, stems from the requirements of military installations, space exploration, etc., where efficiency may be secondary to compactness and robustness, and economic generation is not a prime consideration. The plasma diode is potentially the lightest in weight of all direct conversion devices. Design projections indicate that a weight-to-power ratio of less than 1 lb/kW could be achieved—which would make it an obvious choice for space vehicles. In such applications, solar rather than nuclear heat sources would probably be used.

Power for space exploration does not add significantly to man's present use of energy; perhaps it never will. But it has an importance far beyond its kilowatt rating. It raises among engineers and scientists a host of new problems to be solved, new challenges to be met, and new frontiers of knowledge to be probed, leading to that greater exploitation of our natural resources on which the very survival of our technological civilisation may depend.

The author is indebted to the English Electric Company for permission to publish.

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Electricity Aids Trawling Research

ELECTRICITY at sea plays a major role, not only in large ocean liners, but also in smaller vessels such as the new motor trawler *Clione* which incorporates all-electric auxiliary machinery and equipment. Built as a research ship for the Ministry of Agriculture and Fisheries, her function will be to experiment with trawling methods, survey plankton concentrations and generally to investigate problems pertaining to yield from fishing grounds. Secondary duties will include carrying out hydrographic surveys.

Active Rudder

Extreme manoeuvrability is an essential requirement for a vessel intended for marine survey duties; she must be able to maintain fixed bearings, when required, against the effects of wind and current. For this reason, *Clione's* main propulsion and steering is supplemented by an electrically driven propeller integral with the rudder itself. The combination, known as a Pleuger "active rudder," enables the ship to turn almost within its own length, with precise speed variations between zero and five knots ahead or astern, controlled by push-button from the bridge. The Pleuger motor is a water-lubricated, squirrel-cage type, deriving its power from a variable frequency motor-alternator having a nominal three-phase output of 120 kVA at 380 V, 50 c/s.

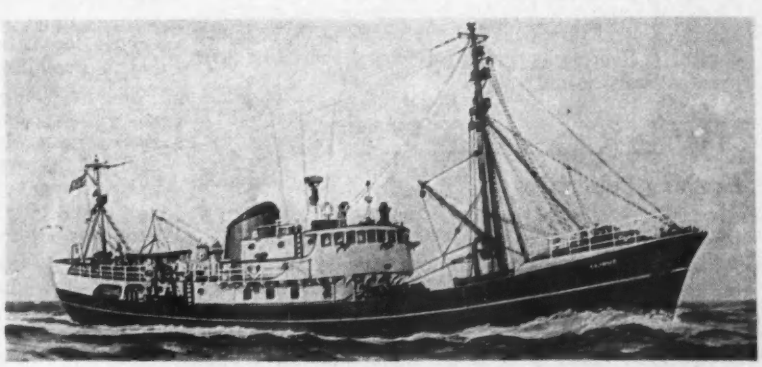
Power Supplies

Clione's main trawl winch, rated at 260 h.p. with a motor speed of 650 r.p.m., is supplied from a Laurence Scott and Electromotors generator driven by a Ruston and Hornsby oil engine and rated at 212 kW. The circuit incorporates Ward Leonard speed control. The winch generator performs the additional duties of powering the rudder supply motor-alternator or providing a supplementary general supply at constant voltage. Two 102 kW, 240 V generators cater for the ship's main d.c. power demand, which also includes electric heating. These, like the majority of machines on board, are also of LSE manufacture, and are driven by Ruston Paxman engines. Besides the Pleuger rudder, the ship's laboratory also requires a.c. power. To meet this demand there is a 32·25 kVA motor-alternator installed. A further source of auxiliary power is provided by a 20 kW d.c. generator, whose prime mover also drives an air-compressor.

Apart from winches, other motor load on board *Clione* includes bilge and general service pumps utilising 5 h.p. motors. There are also pumps for standby duty and fuel transfer, employing 3 h.p. and 1½ h.p. motors, respectively. Engine-room ventilation is assisted by a 19 in. electrically driven fan and there is an engine-room work-bench fitted with a powered lathe, grinder and drilling machine.

Although taking only a small portion of the electrical load, not least in importance is *Clione's* radio, radar and acoustic fishing and navigational aids. Marconi Marine have installed the radio telephone and direction finding equipment, together with an internal loudspeaker system and other facilities. Radar equipment by Decca has a peak transmitting power of 75 kW giving a maximum range of 48 miles.

Electrical installation was carried out by Wm. Broady and Son, who also manufactured the 21 ft long switchboard which is mounted athwartships in the engine room. The switchboard controls the four generators, which can be arranged in parallel, and also the laboratory alternator supply. It also incorporates facilities for connecting a 415 V, three-phase, four-wire shore supply when the ship is in port. Under these circumstances, d.c. supplies are obtained from a 20 kW transformer rectifier unit.



Ministry of Agriculture and Fisheries' research trawler "Clione"

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Neutral Current from Lighting

I SHOULD like to make the following observations regarding the article by Mr J. Flood on "Neutral Current from Lighting" (16 March issue).

The author has not explained that the presence of harmonic currents is the reason that the power factor of lagging switch-start circuits (Fig. 1a) cannot be corrected to unity, i.e., the capacity current is of fundamental frequency—assuming sinusoidal supply voltage waveform—and can only counteract the fundamental reactive component of the lamp current. Thus, as the power factor is increased, so the percentage of harmonic current is increased, since the fundamental current is reduced whilst the harmonics are unchanged in magnitude. If the supply voltage contains harmonics, the low harmonic reactance of the capacitor may result in a further increase in percentage harmonic current.

No mention is made in the article of the circuits commonly used in twin-lamp fittings, i.e., one lagging current switch-start circuit and one leading current switch-start circuit. Both fundamental reactive and harmonic currents in these circuits tend to cancel, thereby producing very nearly unity power factor and reduced harmonic currents in the neutral.

Table 1 in the article gives the impression that the 8 ft 125 watt switch-start circuit has a leading power factor of 0·7 which cannot be corrected, whereas it is quite simple to correct the power factor by means of a small choke connected in parallel with the circuit.

J. E. Greehill, GRADUATE I.E.E.,
LONDON, N.9.

* * *

MR McNEILL (23 March) does not say why the simple semi-resonant switchless start circuit should not be generally adopted but goes into the question of balancing, etc., and also introduces the question of low neutral currents produced by a new twin-start 8 ft, 85 W circuit.

Most engineers will agree that the proper place to correct the harmonic content is at its source in the lighting unit, rather than rely on balancing fittings in local areas over the three phases of the supply system or assuming twin lamp fittings will be available or suitable for use in all locations.

I was pleasantly surprised at the interest created at the Electrical Engineers' Exhibition in this particular subject, and the general agreement that the control of the harmonic content in fluorescent lighting equipment should be given more attention in the future.

J. Flood, ASSOCIATE I.E.E.,
LONDON W.4.

Earthing Difficulties

ON reading your report of NICEIC inspections in the issue of March 16 and *Megohm's* comments of March 23, I am left wondering if all the cases of ineffective earthing were due to faults in the installations under test. I have known more than one installation branded as "ineffectively earthed" where the defect was subsequently found to be in the supply authority's transformer earth.

For this reason and because a supply is often not available to the contractor until the board's installation inspector has tested, it seems to me that a loop impedance tester is not of great use to us.

Regarding e.l.c.b's, could it not be said that where a parallel earth path exists which makes the trip coil inoperative, the fire and shock risk is no greater than when reliance is placed entirely on normal fusing with solid earth?

Megohm's comments on earthing are indeed welcome. The whole matter is very unsatisfactory, especially in rural districts, where difficulties arise because of the soil and plastics water mains, and the immersion heater still giving us the parallel path across the e.l.c.b.

S. R. Pratt,
SWINDON,
WILTS.

Parallel Earth Paths

WITH reference to the Notes on Wiring by *Megohm* in your issue dated 23 March, I would be interested to know how he would deal with the problem of parallel earth paths. There is a school of thought which suggests that such parallel fortuitous earth paths do not reduce the degree of protection afforded by the earth-leakage circuit-breaker.

On the other hand, there are various ways in which earth-leakage circuit-breakers are installed in order to ensure positive operation, for example, connection of the trip coil direct to the neutral or the insertion of a section of non-metallic piping so as to increase the resistance of the parallel earth path. IEE Regulation No. 410 covering method of installation and regulation 506 states "the effectiveness of earth-leakage circuit-breakers shall be verified", but can we be sure that where these parallel earth paths earth, the circuit-breaker will afford the protection necessary in order to satisfy the basic requirements for earthing, as laid down in IEE Regulation 406, Note 1?

Helios.

Indian Locomotives

I WOULD refer to the article in the ELECTRICAL TIMES of 9 March, 1961, p. 373, and draw your attention to the error regarding the suppliers of the electric locomotives for the electrification of the Great Indian Peninsular Railway between Bombay-Poona and Bombay-Igatpuri.

I was representative and chief engineer for the consulting engineers Merz and McLellan—later Merz and Partners—on this work from June, 1925, to January, 1932, and would advise you that of passenger locomotives supplied 22 were of Metropolitan-Vickers manufacture—one Brown-Boveri and one General Electric.

As to the freight locomotives, when I left India, 41 of Metropolitan-Vickers manufacture had been supplied and were in service.

G. E. F. Webber, M.I.E.E.,
MACKWORTH,
NR. DERBY.

100 MW set operation at Castle Donington

4½ YEARS' EXPERIENCE REVIEWED

BY 1950, when the Castle Donington station of the CEGB East Midlands Division was in the design stage, it was possible to break away from the standard 30 MW and 60 MW sets and to consider the new developments in design and construction which could be incorporated in larger stations with sets of 100 MW rating. The paper* presented to the steam plant group of the Institution of Mechanical Engineers at Derby on 23 March described the station design and summarised experience gained over 4½ years at this 600 MW station, which was large at the time when it was designed and which was also the first station in this country to use double-shell construction for the high-pressure turbine.

Following the practice established for 60 MW stations, and despite the increased size and unusual features of the sets, unit construction was chosen from the outset. Strict duplication of the units from the gas ducts to the generator transformers was the design aim with no interconnecting ducts on the steam side. The station has six 100 MW sets with unit boilers rated 830 klb/hr at 1,500 lb/sq in. 1,060°F.

Commissioning

The commissioning programme for No. 1 boiler was completed in only four weeks to meet the agreed date. The procedure adopted was a preliminary alkaline "boil-out," followed by a 24-hour soak with hydrochloric acid and a further 24-hour neutralising boil-out. Leakage detected during the initial boil-out was remedied by seal welding all expansions of the 4 in. tubes into the bottom boxes. The first turbine was put on load in September, 1956, but further adjustment and balancing delayed full-load runs until the December. Since then it has been operating with excellent results. Similar commissioning procedures were adopted for the other units except that for Nos. 4 and 5 boilers, sulphuric acid was used for the acid clean. The sixth set was put on load in May, 1959.

The load factor for Castle Donington since commissioning was between 82% and 90% until mid-1960, except for a fall to 50% in 1958 occasioned by mechanical breakdown. From 1956 to 1959 the station led the CEGB efficiency figures, attaining 33% in 1958-59. Efficiency fell during 1959-60 because the hot, dry summer required prolonged use of the cooling towers, with consequent pumping losses. The advantages of the larger sets and design improvements are indicated by reduction in building volume to 27·5 cu ft/kW from the 40 cu ft/kW for a 30 MW station, and a capital cost of £50·4/kW installed, including main switchgear, compared with £62·5/kW for a 30 MW set and £53·2/kW for a 60 MW set, based on actual costs at time of construction.

* "Some Features of the Design and Operation of the Castle Donington Power Station," by J. O. Grieves, A. H. Parish and J. S. Hall. Mr Grieves is station planning engineer, CEGB; Mr Parish is with Babcock and Wilcox; and Mr Hall is with AEI, Manchester.

Boilers and Auxiliary Plant

The total boiler availability loss due to outages for the station as a percentage of the total evaporative capacity was only 9½% from December, 1956, to June, 1960. Apart from 4·2% attributed to annual overhauls, the largest loss of availability was 1·8% due to superheater failures. On No. 4 boiler a superheater tube failure after 600 hr steaming was attributed to overheating following internal obstruction. After 6,000 hr, a crack developed at a point of high stress, at a dent thought to have been caused during assembly, in that section of the secondary superheater using austenitic steel. Austenitic steel was used in the boiler only in the high temperature section of the secondary superheater. After 16,000 hr steaming, a piece blew out of the austenitic section on No. 1 boiler, apparently because of prolonged overheating, also caused by a partial blockage.

All boilers have, in the last two years, shown evidence of wastage on the gas side of the furnace tubes. Although not yet fully understood, the trouble seems confined to the high gas temperature zone of the furnace where intermittent flame impingement occurs with lack of adequate combustion air when the fuel used has an ash high in the alkali metals, sodium and potassium. Increasing total air at the p.f. burners or burning fuels low in chlorine can suppress this trouble.

Failures on i.d. and f.d. fans resulted in 0·6% boiler availability loss. The trouble was due mainly to bearing

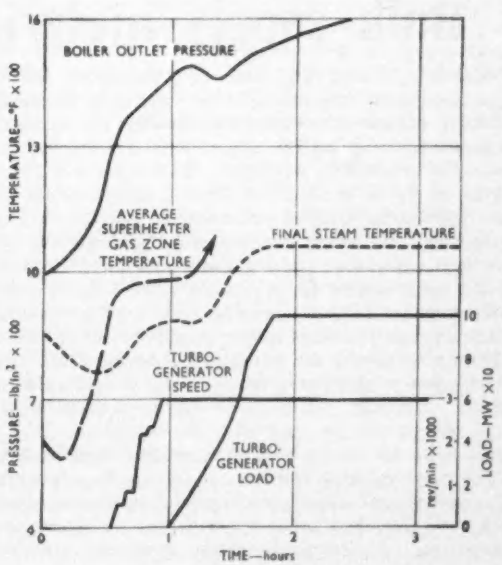


Fig. 1. Improved starting procedure. A recent hot start after a 6 hr shutdown. The original procedure used took 3¼ hr for the generator to attain full load and 1¾ hr before it was synchronised

overheating attributed, after tests, to excessive end float and thrust of fan motors combining with fan thrust.

Turbines and Generators

The main features of the turbine design adopted were the double-shell construction for the h.p. cylinder and use of a rigid coupled three-bearing rotor. Although both these features were established American practice at the design stage, their application to 3,000 r.p.m. machines still required careful study. Test results showed that the average efficiencies of the turbines exceeded 85%, including an exhaust loss of 1½% at 28·9 in. vacuum.

The double-shell construction chosen for the h.p. cylinder has proved successful, although analysis of the mechanical advantages and disadvantages showed only marginally in its favour. The outer shell's low running temperature of 840°F was the great advantage in its favour, even though this resulted in a rotor differential expansion with respect to the outer cylinder which was greater than normal. The pressure between shells at full load was 289 lb/sq in. and this enabled the thickness of the inner shell to be reduced from 6 in. to 4 in. The paper outlined the advantages of the Baumann exhausts used and described the experiences obtained with bearings and the water-paddle seal at the inlet end.

Starting the turbines after a six-hour shut-down proved difficult, and work was done to devise a reliable procedure. On Nos. 1 and 2 machines, which have separate, wheel-type l.p. turbine rotors, the wide speed band covering the two critical speeds had to be taken into account to ensure run-up without noticeable vibration. Similar tests were to be made on the four other turbines, which have solid, forged rotors for the l.p. turbines.

The 100 MW generators are cooled by hydrogen at ½ lb/sq in. They were the first machines of their type to have a direct cooled rotor in which the gas flows through passages in the copper conductors. The main and pilot exciters are driven at 1,000 r.p.m. from the main machine through reduction gearing, and the excitation is controlled by rotating amplifier regulators.

Hot Starting Problems

With the normal station operational approach, some trouble was experienced on the turbine during hot starts. Trials were carried out on No. 2 unit and the improved procedure, shown in Fig. 1, was adopted until further trials could be made. With the improved starting procedure, the time to reach full load after a six-hour shut-down has been reduced from 3¼ hr to 1¼ hr, and the feed water consumption has fallen from 24,000 gallons to 8,300 gallons. To ensure acceptable steam conditions during start-up, the boilers have oil burners capable of automatically igniting the pulverised fuel and also of carrying up to 10% full load. The revised starting procedure permitted a reduction in fuel oil consumption from 6¼ tons to 2¼ tons.

The main improvements in boiler handling resulted from streamlining of individual operations. It was possible, for example, to purge the gas passes while the fans were being started and the dampers set, so reducing the cooling effect on the superheater. Trials also showed that condensate was clear of the superheaters well before high gas temperatures were attained, and it was therefore possible to conserve water by delaying opening of the boiler drains until a definite pressure rise was noted. It was also found possible to pass steam to the turbine at a lower temperature than had originally been thought practicable.

The trials showed that starting could be speeded by controlling two items from the control panel. One faulty start was attributed to lack of remote control of the attemporator isolating valves. It was also found difficult to fit into the starting procedure the withdrawal of the retractable gas-temperature probes with the retracting gear located at drum level. The difficulty of setting air registers and impellers for the p.f. burners quickly, when the unit was being rapidly loaded, was partly overcome by pre-setting, after the first few starts had shown the order in which burner groups were needed.

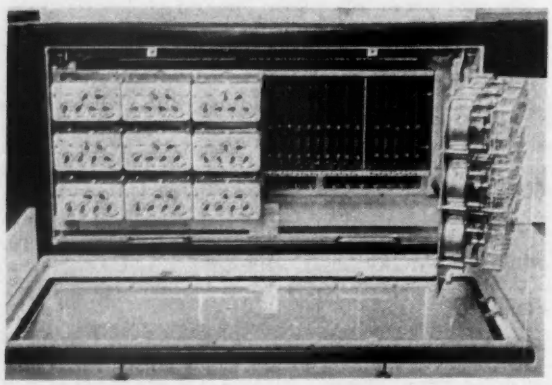
Bulk supply metering

COMPACTNESS and ease of accessibility are two important features of the Ferranti summation metering equipment recently introduced. The equipment accommodates up to 18 display registers, together with electronic summation equipment in a steel case measuring 23 in. by 12 in. by 11 in. This is said to be less than one quarter the size of conventional electro-mechanical equipment. By using transistorised logic circuitry space has been conserved, and the use of standardised printed circuit cards allows for a flexible scheme which can be easily modified to meet changing metering requirements.

The 18 registers which may, typically, be for 16 channels with two totalisers, are mounted on hinged front covers which open to give ready access to the printed card racks behind. Although conventional electro-mechanical watt-hour meters can be used with the equipment, it is the intention to use meters with photo-electric impulse devices.

The most valuable feature, however, is the replacement of conventional electro-mechanical summation devices, with their attendant needs for maintenance, by electronic equipment. If required, single revolution maximum demand indicators and sub-total registers can be incorporated in the summator and the equipment can be used to operate printometers.

Impulsing rates of 10/sec are obtained, enabling each pulse to represent smaller units of power with consequent increased accuracy. Power consumption is only 15 W and the equipment can be totally enclosed and dustproof.



Transistorised summation metering equipment by Ferranti. The 18 register panels open to give access to the printed circuit cards for the summation circuitry. The unit is compact and can be dustproofed

Electrical Times, 6 April, 1961

Mach 4 wind tunnel

NEW SUPERSONIC TEST FACILITY AT R.A.E., BEDFORD

THOUGH Britain may appear to be lagging in the outer space programme, she is certainly no laggard in the field of supersonic flight research. The new Mach 4 wind tunnel at the RAE, Bedford, officially opened by the Minister of Aviation on 24 March, is a valuable and impressive addition to our flight-testing and supersonic research facilities.

The Bedford project, estimated to have cost about £40 million, now comprises four major wind tunnels and a 15 ft dia vertical spinning tunnel. The latter and the three tunnels in operation up to the present, a 13 ft by 9 ft low speed, 3 ft by 3 ft transonic and supersonic to Mach 2, and an 8 ft by 8 ft subsonic and supersonic to Mach 2·8, were described in these pages* when the last-named was opened in 1957. The latest tunnel has a working section 4 ft by 3 ft and, though at present limited to speeds up to Mach 4, it will eventually cover a range from 2·5 to 5. Taken together with the tunnels at Farnborough and the private installations in the aircraft industry, Britain now has supersonic testing facilities among the most extensive in the world.

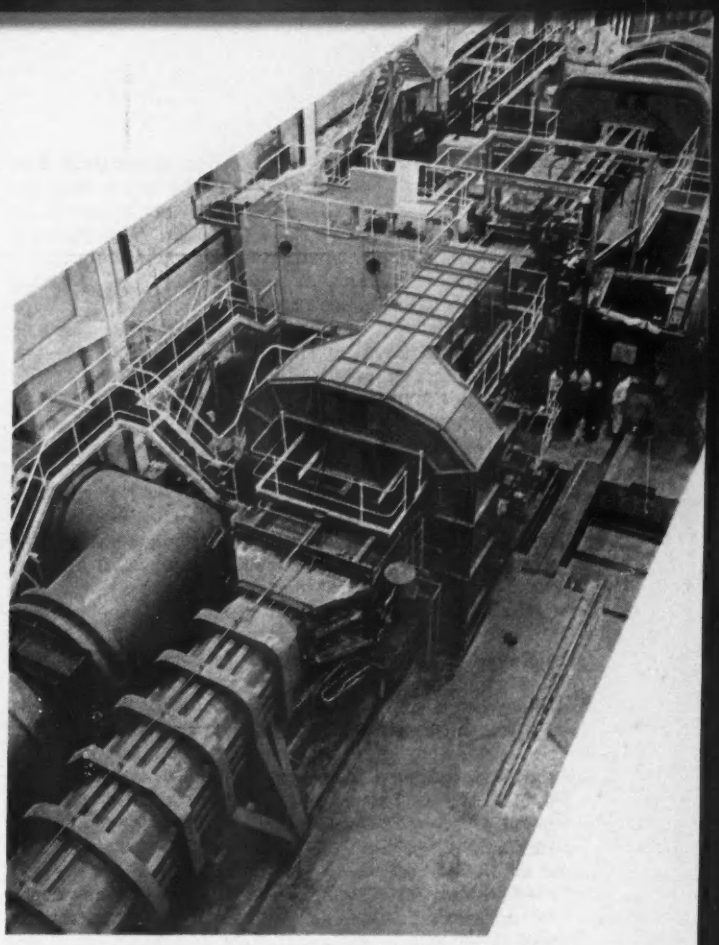


Fig. 1. Working area of the RAE Mach 4 tunnel from the outflow end

The Wind Tunnel

Although the electrical equipment of the wind tunnel is likely to be of greatest interest to readers, a brief description of the general design and requirements aerodynamically will not be out of place. A view of the working area from the downstream end is shown in Fig. 1. In the foreground are the supersonic and subsonic diffusers, the former being bridged by the air-release ducting containing the pressure release valves. Just behind the personnel group can be seen the parabolic Schlieren mirror which marks the centre-line of the window and model on the sting-shaft in the model-support section immediately to the left of the group. The Schlieren beam cone and television camera are contained within the housing on the far side. Beyond the mirror, and bridged by the gantry, is the adjustable nozzle for achieving high Mach No. flows, while in the background can be seen the contraction fairing and screen housings of the inlet section and settling chamber. A sectional elevation of the working section leg is shown in Fig. 2.

The tunnel is of the continuous flow type, air being circulated via ducts at either end. The outlet ducts are clearly visible in the left foreground. Circulation is maintained by two identical motor compressor sets housed in a compressor room to the left of the working section from which it is separated by the control rooms seen immediately above. Since most supersonic flight takes place at high altitudes, provision is made for evacuating the tunnel of air down to 0·1 atmospheres (1·47 lb/sq in.) by means of four vacuum pumps, which can reach this value in less than four minutes. High altitude atmospheres are almost free from moisture and, to simulate these conditions, dry high-pressure air is stored in six conservator cylinders outside the building. These are charged from two 4,500 lb/sq in. compressors through separators which reduce the moisture content to a value not exceeding 18 parts/million. The dry air is used to charge the tunnel circuit and also to provide a degree of pressure control.

Pre-coolers, intercoolers and after-coolers, using water as the coolant, are incorporated in the main compressor circuit, which also includes a by-pass pipeline to enable the compressors to be run up to speed before the working section is connected in circuit. The model-support section and calibration section are similar structures supported on motor-driven cross-traverse transporters. These can be inserted in the tunnel, the casings downstream of the nozzle being movable axially a distance of 11 ft to allow the sections to be inserted and removed. The model-support section contains the rotatable sting-shaft on a movable quadrant which enables the attitude of the model to be adjusted by remote control in relation to the airflow through 5° depression to 27° elevation in pitch and ±180° in yaw. The calibration housing has no quadrant, but a probe housing, in place of the sting-shaft, can be traversed a distance of 2 ft across the airstream and up to 3 ft upstream or downstream, enabling a plot of the airflow to be made in its vicinity.

The Compressors

The compressor house (Fig. 3) contains the two main compressors and their motor drives. In the design stages it had been estimated that the tunnel would require a compressor plant having a range from around 350,000 cu ft/min at an overall pressure ratio of 20:1 in the Mach 5 condition to 470,000 cu ft/min at 2·7:1 in the Mach 2·5 condition. This has been achieved by using two

* ELECTRICAL TIMES, 4 July, 1957, page 3.

sets, each comprising an 18-stage l.p. and 8-stage h.p. tandem-driven compressor direct-coupled to a two-pole, 3,000 r.p.m. 34,000 b.h.p. synchronous motor which, in turn, is coupled through 931·6/3,000 ratio gearing to a 10,600 b.h.p., six-pole, wound-rotor induction motor.

The induction motors are supplied at 11 kV, 50 c/sec and serve to bring the synchronous motors up to speed with the tunnel circuit evacuated to 5 lb/sq in. The gear ratio is chosen so that, when the synchronous motor is at speed, there is still a degree of slip left to enable the induction motor to provide an additional 10,000 h.p. of drive to the compressors. Control of the wound rotor current during run-up is through liquid type controllers each of which is capable of a continuous dissipation of 3,200 h.p. at an electrolyte temperature not above 70°C with a circulation rate of 1,200 gall/min. Water-cooled heat exchangers serve to keep the electrolyte temperature down and close temperature control is essential to avoid change of load during normal running.

This is effected by duplicate sets of controllers, one to maintain a constant temperature of 63°C while running and the other to reduce the temperature to 52°C in preparation for a start. To prevent the temperature falling below 52°C, nine thermostatically controlled heating elements, each rated at 9 kW, are installed in the electrolyte sump. The total quantity of electrolyte in each controller is 2,000 gallons and the liquid is kept in circulation by duplicate sets of pumps. Adjustment of the vanes is via a d.c. geared motor with potentiometric armature current control. The period for the full travel of 42 in. is adjustable between 20 sec and 2 min.

A problem in induction motor drives is that any degree of unbalance between the currents in the rotor windings will cause a cyclic variation in the torque developed with a frequency twice that of the slip-frequency. Relatively unimportant on short, stiff shaft drives, it could assume dangerous proportions on long shaft drives such as in the present case. Anticipating the possibility of such circumstances arising, two protective devices have been incorporated; the first, a slip-frequency monitor to give warning if the exciting torque falls to within 10% of shaft system first order frequency (5½% slip), and the second a device to indicate and monitor drift of out-of-balance currents in the rotor and to sound an alarm if it exceeds 1½% of the mean current. Both alarms coming up simultaneously automatically shuts down the motor.

The induction motor is also used to provide dynamic braking of the compressor by circulating d.c. through the stator windings, the effect being sufficient to bring the unit to rest in under 3 min from full speed.

Synchronous Motors

The synchronous motors are two-pole machines built into standard 30 MW turbo-alternator frames. With a continuous rating of 34,000 b.h.p. at unity power factor and a speed of 3,000 r.p.m. at 11 kV, each motor has a closed circuit cooling system and is capable of developing constant torque on a reduced frequency and voltage at speeds down to 2,160 r.p.m. The reduced frequency characteristic is important in that it allows the sets to be driven at frequencies from 36 c/sec to 50 c/sec when supplied from the Establishment's 40 MW gas turbine generating plant.

An unusual aspect of the double helical drive gearing is that pinion and gear wheels are bored through their shaft lengths to accommodate internal shafts of torsional flexibility. That is to say, the actual coupling between pinion and drive motor is at the further end of the pinion through a tooth-type sliding coupling. This arrangement allows freedom for axial expansion of the high-speed shaft line and also provides a simple method of adjustment for torsional stiffness should actual resonant shaft frequencies differ from calculated values.

Lubrication

Each compressor unit has its own forced oil lubrication and cooling system. A 4,500 gallon tank forms the main reservoir, from which oil is pumped to all bearings by a mechanical pump driven from the set shaft, supplemented by an auxiliary pump coupled to a 50 h.p. induction motor. A 900 gallon header tank provides sufficient flow to enable the set to run down safely in the event of total failure of all pumps. The oil is cooled by four paralleled oil coolers with a total heat extraction of nearly 3½ million B.Th.U's/hr.

Air Coolers and Compressors

Precoolers for reducing the temperature of the l.p. inlet air are designed to cool the total flow to the l.p. compressor from 150°C to 40°C. This is needed at the upper end of the speed range, where stagnation temperatures may reach 150°C. Intercoolers reduce the temperature of l.p. compressor outlet air from 240°C to 40°C before entering the h.p. side. The aftercoolers lower the h.p. outlet air from 245°C to 40°C for use in the working section.

For providing dry air to the storage cylinders, two sets, each comprising a six-stage, double-acting, six-cylinder horizontally opposed Harland and Wolff compressor direct-coupled to a 1,330 b.h.p. 3·3 kV slip-ring induction motor, are located in the auxiliary plant building. The storage cylinders are six in number, each being 4 ft dia by 45 ft overall length. They provide a combined storage capacity of 3,228 cu ft, sufficient to provide rather more than 60,000 lb of air when allowed to discharge down from 4,500 lb/sq in. to 700 lb/sq in.

The volumetric capacity of the tunnel circuit is, roughly, 46,000 cu ft; the stored air is, therefore, sufficient to purge the moisture present in the tunnel circuit after it has been open to atmosphere, a process which requires a number of charges of dry air to be supplied within a period of one minute at intervals of five minutes.

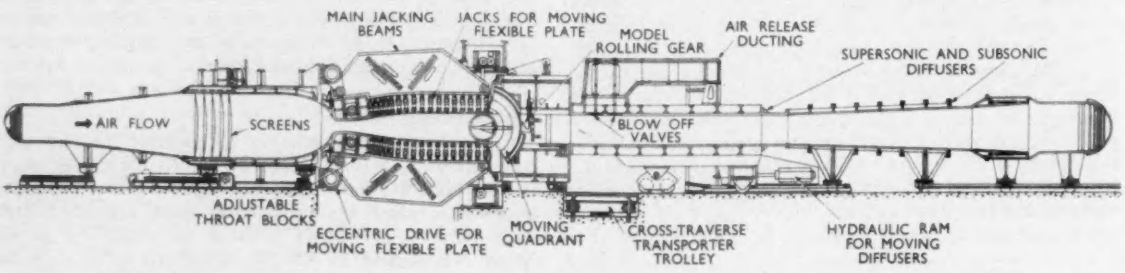


Fig. 2. Line diagram showing a sectional side elevation of the RAE Mach 4 wind tunnel. Compare with the view in Fig. 1

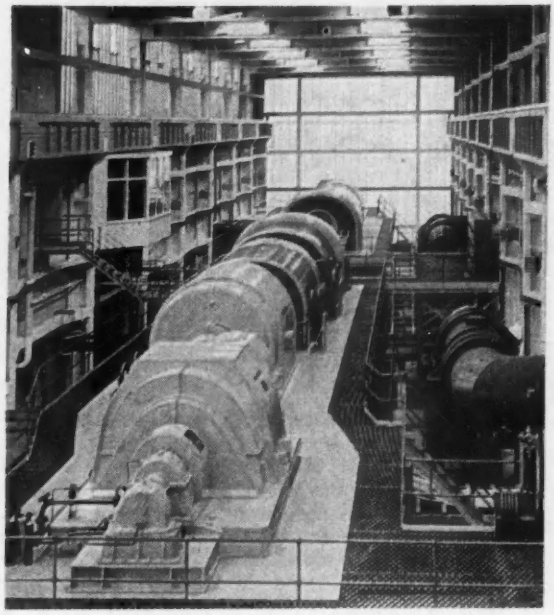


Fig. 3. View of the compressor house showing the main compressor units with a combined motor load of 88,000 h.p.

Vacuum Pumps

To simulate high altitude conditions in the tunnel, four vacuum pumps are provided. Each unit comprises a horizontal, twin-cylinder, double-acting, water-cooled vacuum pump coupled by multiple vee-belt drive to a 375 b.h.p., 3,300 V slip-ring induction motor to give a pump shaft speed of 157 r.p.m. They are locally started and stopped on instructions from the control room.

Cooling Towers

Cooling water from the compressors is circulated through a cooling tower mounted over the cooling-water pond. The tower is divided into seven cells, each equipped with a 24 ft dia, six-bladed induced draught fan driven by a totally enclosed weatherproof, squirrel-cage, 115 h.p. motor.

Circulation between the coolers and the pond is maintained by five 7,200 gall/min, 85 ft head pumps coupled to 240 b.h.p., 985 r.p.m., s.c. motors, which drive the water through the 48 in. nominal diameter mains.

Control and Instrumentation

Control is centralised on three desks in a sound-proof observation room between the main compressor plant and the tunnel. The centre desk accommodates the positional control for the movable walls of the nozzle and supersonic diffuser, to be described later, and for the positional adjustment of the model under test. The right-hand desk accommodates the television and Schlieren displays, together with the associated controls. The left-hand desk incorporates the grouped controls for valves used to adjust the air pressure, flow and temperature and for starting and shut-down of the tunnel. Indicating instruments provide positional information of all valves, air conditions, etc.; annunciators give indication of the availability of essential services.

Instrument panels in the observation room also show the curvature of the flexible walls of the nozzle at each station with remote controls for the corrector unit. The control system is fully provided with interlocks and similar safety features to prevent unauthorised or inadvertent misuse of controls and all are designed to fail to safety.

The Ajustable Nozzle

The adjustable nozzle, which will eventually be installed in the section preceding the working area and which will give the full range of the tunnel from Mach 2·5 to Mach 5, is of special construction. It comprises two fixed side walls with movable top and bottom walls 3 ft wide by 26 ft long. PFTE seals faced with silicone rubber provide the sealants between the fixed and movable walls.

The movable walls are each carried by a pair of stiff fabricated beams, pivoted at the downstream end. At the upstream end, each pair carries a throat block of fixed contour which can be driven upwards or downwards, to vary the throat gap, by a separately excited d.c. motor through a 4,000:1 reduction gear and an eccentric. Between the two ends are 3 ft wide flexible plates bridging the gap, the back surfaces of which are reinforced by a number of transverse ribs coupled to ball-screw jacks driven, in opposing pairs, by 0·25 h.p. 1,000 r.p.m. separately excited d.c. motors supplied by a variable voltage generator.

The nozzle controller comprises a number of linear plate cams mounted on a surface table which is traversed under a head-carrying device to sense the ordinates of each cam. The sensing devices, magslip transmitters driven through precision racks and pinions by the cams, are aligned with other magslip coincidence transmitters mounted on the fixed beams above the moving walls to sense the position at each station. Misalignment between the two transmitters produces an error signal, which is amplified and applied to the fields of the jack motor generators driving the jacks to a position where the signals cancel out, so setting the contour of the moving walls to conform to the selected position. Selection of the particular cam-plate position is controlled, through a similar positional servo, from the desk in the observation room. For the time being, a fixed nozzle, corresponding to Mach 4, is installed as a temporary measure.

Pitch and Roll Drives

The attitude of the model while in the tunnel is sensed and controlled by electrical devices comprising separately excited 1 h.p. d.c. motors coupled to a variable voltage generator and magslip transmitters. The desired setting of pitch and roll having been applied to the master transmitter, any misalignment between this and the coincidence transmitter on the model support is developed as a voltage in magnitude and direction applied to the field of the variable voltage generator which, in turn, drives the model to the desired attitude. Indication of the position is provided by digitisers of a new contactless design developed to overcome the difficulties experienced with segmental types. A list of main electrical contractors is given below.

ELECTRICAL CONTRACTORS

Main compressors, motors, control gear	A.E.I.
Working section equipment	G.E.C.
33 kV switchgear	English Electric
11 kV switchgear	English Electric / A. Reyrolle
25 MVA transformers	Johnson & Philips
20 MVA transformer	C. A. Parsons
5 MVA transformer	Ferranti
Power and control cables, external	Crompton Parkinson
Control and instrument cables, internal	L.E.B.
Closed circuit TV	Pye
Intercommunications	Tannoy Products
Lighting and ancillary cabling	G. E. Taylor

Solid aluminium cables

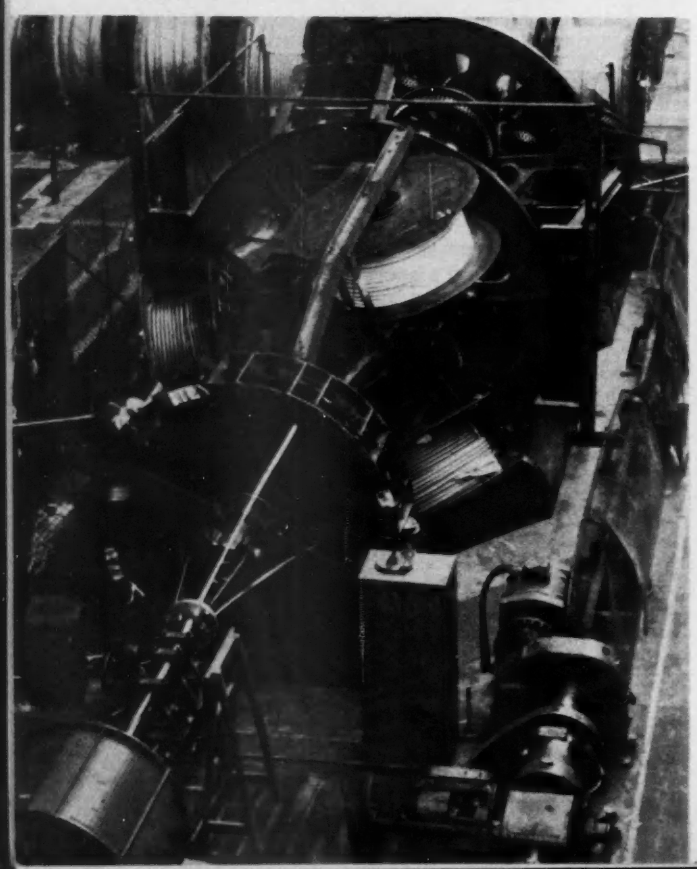
PART 3. MANUFACTURING TECHNIQUES

THE design and installation of "Solidal" cables having been covered in previous sections,* we shall conclude this survey by a short description of the manufacturing techniques in so far as they may differ from those for conventional stranded conductor cables. Most of the leading cable makers have already assessed problems associated with the production of "Solidal" cables and so are familiar with the points which are described. Other manufacturers may, however, be interested in learning to what extent they may have to vary their own processes, which often include sub-processes or techniques developed by them and which may need adaptation.

Standard Specifications

A British Standard is, as yet, not available for this class of cable, though its preparation is already being considered. A comparable specification, modelled on similar standards for other cables, has been prepared by the Alcan Group of Companies. This is being revised and copies will shortly be available to any person who is interested in the manufacture or use of the cables on application to any of the offices of the Alcan organisation. The specification covers the manufacture and test requirements for three-core, p.v.c. insulated cables with concentric neutral for supplies up to and including 1,100 V r.m.s. between phases or 660 V r.m.s. between any one phase and neutral.

* ELECTRICAL TIMES, 1 December, 1960, and 26 January, 1961.



Laying-up the three "Solidal" conductors on a 3-bobbin machine (Pirelli-General Cable Wks Ltd.)

Phase Conductors

Sector phase conductors may be made by extrusion, by rolling and drawing or by the Properzi process. The conductors need not be pre-twisted. A basic requirement for the conductor is that the maximum resistance per unit length shall not exceed a specified value. The standard dimensions are chosen in relation to material having a relative conductivity of 61·5% I.A.C.S. which represents normal production in most countries and gives an adequate margin.

The sector cores can be welded with any good design flash butt-welder. It is, however, necessary to make special grips to ensure accurate positioning of the sectors. A simple technique has been developed for precision dressing of the welds. The weld "flash" can be simply brushed off if the dressing operation is carried out immediately after the welding operation; otherwise the flash needs to be dressed by a snipping and compressing operation.

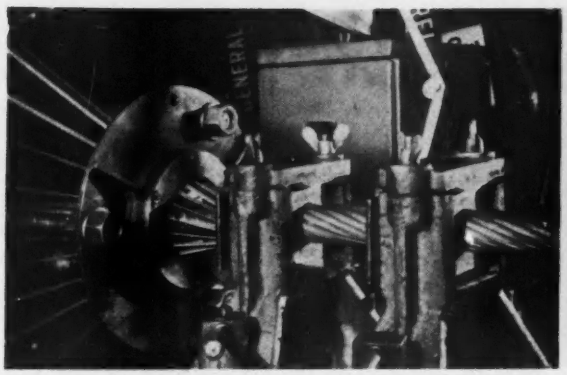
Spooling

Lengths of solid core should be supplied, carefully layer wound on reels or spools. Precautions must be taken to avoid sharp kinks at the ends of each layer as these may be difficult to straighten adequately during the insulation covering process. A little care taken at this stage saves a great deal of time and trouble in subsequent operations.

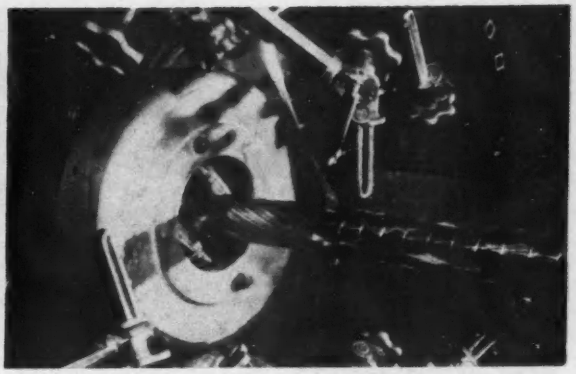
Extruded Sector Conductors

Extrusion processes follow normal practice but note should be made of the dimensional tolerances, particularly as regards the cross-sectional area. It is possible to extrude within the limits of ±3% of area laid down in the specification and this is done regularly in commercial practice. Some producers may, however, find it more convenient to extrude slightly oversize and reduce to accurate size by making a light drawing pass of the order of 5% or less.

The cost of the extra operation may well be justified by savings in extrusion die maintenance, less oversize scrap and improved output from the extrusion press. The method also simplifies production of measured lengths of core without holding up work on the extrusion press. Finally, welds included in the core can be made before the final drawing pass to give an improved finish to the joint area, simplifying the refinishing process which would normally follow a butt-weld. A 5% reduction in area during drawing will not materially alter the hardness of the final core.



Applying the flat neutral earth strands to the laid-up 3-core plastics-insulated cable. This operation is carried out on a normal type of stranding machine



The lapping head applying the "Melinex" tape in a tight binding over the neutral/earth strands immediately after the preceding operation (Pirelli-General Cable Wks Ltd.)

Rolled and Drawn Conductors

For rolled and drawn cores, any conventional rod-rolling machine may be used. The core is first rolled to the nearest convenient shape, usually an oval, in the pass rolls, afterwards being drawn to final shape and dimensions on single or tandem bull-blocks in the ordinary way for sections of equivalent size. After rolling and drawing to dimension, the conductors must be annealed.

Cast and Rolled Conductors

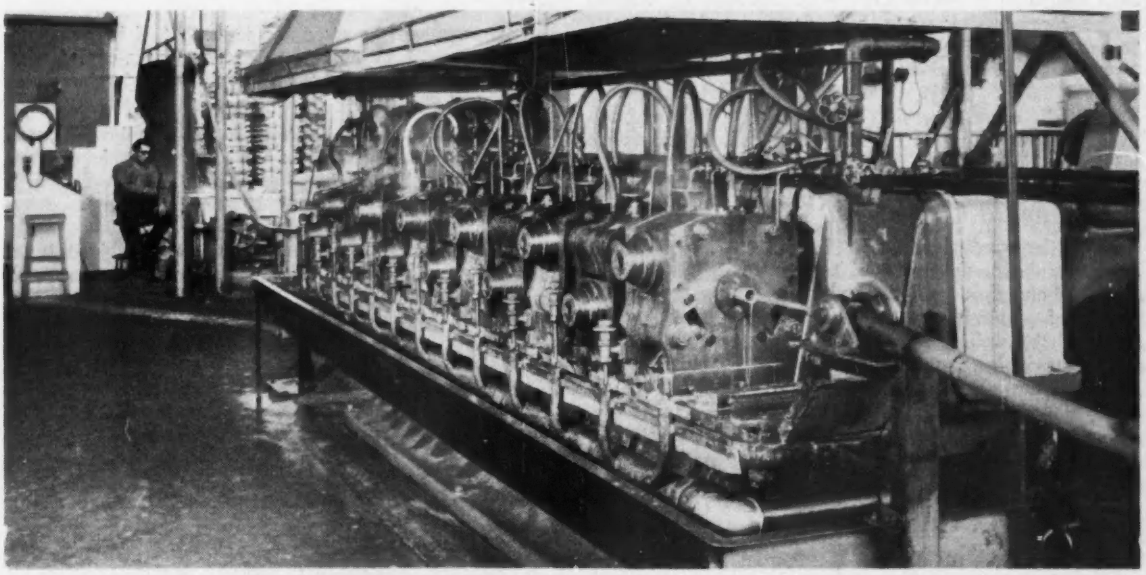
Perhaps the cheapest way to produce solid core sector conductors is by the Properzi continuous casting and rolling process, now popularly employed in many countries for producing aluminium re-draw rod for the wire industry. The machine casts a triangular bar of about 1½ sq in. section continuously and rolls it in a multi-stand mill to rod of about ⅜ in. diameter.

The Properzi machine could be adapted to the production of the sector conductor by the introduction of special, quickly interchangeable roll stands designed to deliver the conductor to the correct shape and to close tolerances. A final light drawing pass is then required to ensure that the section is accurate before final annealing. In this way the solid sector conductor could be produced for little more than the price of re-draw rod, which requires much additional drawing, stranding and compacting before it becomes a cable conductor.

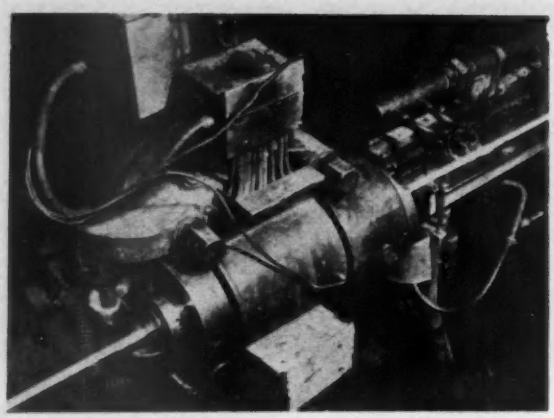
Neutral/Armour Wires

For ease of production, rectangular neutral/armour wires have been designed to have a width/thickness ratio of not more than 5:1. The wires can, in fact, all be drawn directly from 10 mm (⅜ in.) diameter re-draw rod to flat wire of the finished dimensions and the correct temper on most of the straight-through, nine-die, wire-drawing machines with which the majority of aluminium cable makers are equipped. Alternatively, the wires can be made by flattening drawn round wire of appropriate diameter. The choice of method will inevitably depend on the equipment available and the production rate and demand.

The neutral wires may be rolled or drawn with a transverse curvature equal to the mean radius of curvature of the annulus into which they will be stranded. Opinion is divided on the question as to whether this is a desirable refinement or not.



The "Properzi" continuous casting machine in operation. Molten aluminium from the furnaces at the far end is cast into a continuous bar. This enters the roll section to pass through a series of rolls which reduce and shape the conductor to the required dimensions and configuration (Olympic Cables (Pty) Ltd.)



View of the plastics extrusion head with the "Solidal" conductor entering from the left. As the conductor passes through the die, a coating of p.v.c. is applied and cooled by the water jets seen on the right
(Sterling Cables Ltd.)

Plastics Covering

"Solidal" cables have been so designed that all of the plastics extrusion-covering operations, from insulating the 100 A cores to applying the outer sheath of a 400 A cable, will fall comfortably within the capacity of any good make of 110 mm (4½ in.) plastics extruder equipped with a caterpillar or large diameter haul-off. When insulating the sectors, care should be taken to ensure that the core enters the extruder straight, centrally and in full alignment with the die. Light straightening rolls at the entry to the machine are desirable, but care must be taken to see that the surface of the conductor is not marred in the process.

As the sector conductors are not pre-twisted, the insulation can be extruded without vacuum drawn-down at the die but, in this case, more care is necessary in inserting the conductor in the die, particularly in avoiding rotational displacement. In general, extrusion from a circular or elliptical die with vacuum draw-down has produced the most consistent results.

For the insulation of phase conductors, coloured p.v.c. compounds are normally used. Alternatively, p.v.c. of one base colour may be employed throughout providing that each conductor is clearly identified by an adherent coating of appropriate colour or by printed word at closely spaced intervals. The latter methods make core production more economic for short runs since no time is wasted in changing colours in the extruder and coloured compounds are initially more expensive. In quantity production, however, with long runs in each phase colour, the economic advantage falls.

Laying-up the Conductors

Since the conductors do not have to be pre-twisted, a planetary laying-up machine is not required. A simple three-bobbin rigid machine will suffice and, since the weight of a bobbin of aluminium core is only about one-third of the weight of a bobbin of copper core, a less massive machine can be used. Alternatively, higher rotational speeds can be adopted with a heavier machine.

No difficulty should be experienced in closing the three cores. They will fall together quite naturally and securely. They must be tightly bound with the "Melinex" tape immediately behind the closing die and, in the same operation, by p.v.c. tapes over the "Melinex" tape.

Applying the Neutral

Flat concentric neutral wires never exceed 18 in number and are so designed that they can be applied in the 18-bobbin cage of any normal cable stranding machine. If the machine should be of the planetary type, the planetary gear should be disconnected and the bobbin cages locked.

The current equalising tape and the barium chromate tape should also be applied in this operation, the latter being tightly lapped to hold the armour wires firmly in position pending the application of the p.v.c. oversheath. The chromate tape consists of a textile tape impregnated with barium chromate applied as a suspension in water and dried, or in a suitable volatile vehicle. The vehicle must, of course, have no adverse effect on the p.v.c. compound and should be substantially water-permeable.

500 MW Set Design

DETAILS have been released of the design for four 500 MW tandem-compound turbo-generators to be built by C. A. Parsons for the CEGB. An announcement of the £13 million order for these machines was noted in the ELECTRICAL TIMES of 16 March.

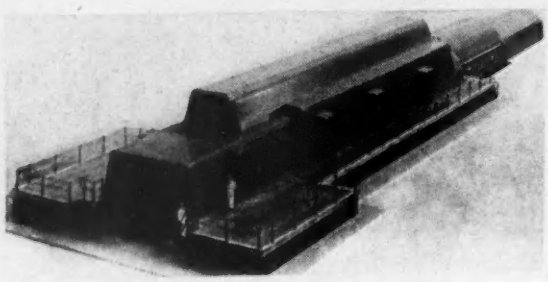
Designed for operation at 2,300 lb/sq in. 1,050°F with reheat to 1,050°F, the turbines will consist of an h.p. turbine, from which steam is exhausted to the reheat section of the boiler, then a double-flow i.p. turbine and then to double-flow l.p. turbines. The h.p. cylinder is of double casing construction and the i.p. cylinder of partial double casing construction; each of the i.p. cylinders will comprise an outer fabricated shell and a cast inner blade carrier. Cascades are to be fitted in the exhaust of each h.p. cylinder.

Both h.p. and i.p. turbine shafts are to be of hollow construction, to give a thermal inertia comparable with that of the casing, a factor of importance in rapid starting and loading. The machines will have seven stages of feed heating, feed water being raised to a final temperature of 485°F at full load.

Generators will be rated for 588 MVA, 0·85 p.f., with generation at 22 kV. Rotors will be hydrogen-cooled with pressure range 45 lb/sq in. to 60 lb/sq in., while demineralised water will be used as a cooling medium for the stators.

Construction of both rotor and stator follows normal practice; but incorporation of the cooling techniques is an important factor in making possible 500 MW rating with a frame size that stays within the limits imposed by transport considerations.

Excitation for each generator will be provided by a direct-driven a.c. exciter, feeding the main generator rotor through a silicon rectifier.



Model of 500 MW single-line turbo-alternator

NOTES ON WIRING

BY MEGOHM

BRITAIN'S largest trade show, that is what the Tenth National Electrical Engineers Exhibition was called when it opened recently at Earls Court. A just claim, indeed, and one which proved that electricity can be harnessed to serve the smallest house or the largest factory. I was interested to learn on more than one stand that a new type of visitor had been seen around the exhibition. These were people who are having their houses wired for electricity and wanted to see for themselves the accessories, etc., which are used on installations.

This, to me at any rate, is a welcome sign. Perhaps if we can get these people to bring their architects with them we might see some results of our attempts to educate the public. Of course, there were stands which showed the educational and training side of the industry and these seemed to be popular with visitors.

My trouble, once again, was finding the time to visit all the stands I had earmarked for attention. Some blame must be placed on the manufacturers who put on such interesting exhibits that I was tempted to linger longer than I ought to have done.

Accessories

Marbourn Ltd. displayed their range of switch and socket units and I was quite impressed with the quality and price of these products. This firm market a conversion mounting box for converting a single flush socket outlet into a twin unit without disturbing the original box. I was particularly interested in this firm's "Plusflex Assemblies" which consist of a length of flexible cable with a standard 13 A fused plug on one end and a specially designed shuttered connector on the other. This assembly is for that situation where an extra extension to a piece of apparatus is required. The assembly is available in two lengths, three yards and six yards, and extremely well made and tested. A nice range of accessories, indeed, and I was pleased to make their acquaintance.

M. K. Electric, as usual, had a wonderful display of their products which need very little description by me. Great interest was being shown by visitors at this stand in the luminous indicator which I described some weeks ago. This has proved to be more than just a "gadget" and has been used to good advantage in many situations; and I know of many more where it will be applied after its first public appearance. This firm's well-known plate-switches were on show; the range has been extended to include a unit having three switches within the compass of a $3\frac{1}{2}$ in. square plate and suitable for mounting in plaster depth boxes with $2\frac{3}{4}$ in. fixing centres. Their 5 A and 15 A ceiling switch range has also been extended and has met with general approval throughout the contracting world. Another new item was the flex outlet plate which incorporates a fuse. Altogether a most impressive display of accessories.

Another fine display was found on Nettle Accessories' stand, with so much to note that I found it difficult to gather all the information. The new cooker control unit with 45 A switch, 13 A switchsocket outlet and neon lamps was certainly a talking point. The flush mounting model is designed to fit a standard two-gang BS 1299 type box. Neat in appearance, well made and electrically "first class" this should prove a winner. The surface model, complete with pattress, fits on top of a single gang BS 1299 box. This unit should prove useful where normally a 30 A circuit is terminated in the kitchen in a single gang socket, this being almost standard practice these days!

Another "standard" practice in the building trade today is that of bad plaster finish around switchboxes and Nettle have produced a thin flat plate to site behind the switch to cover such bad work. It seems a pity that such a thing must happen, but this design does help out in a bad situation. Other items shown were a combined socket and spur connector to serve that fixed fire and yet leave a socket for the cleaner, a "fireside" adaptor having two 5 A sockets and one 13 A socket all controlled by a 13 A fuse, and a water heater switch identical in design to the cooker switch.

Lighting Fittings

Rowlands Electrical had a display of floodlights and industrial lighting fittings. I was informed on this stand that great interest is being shown in the smaller flood-lanterns for domestic floodlighting. This firm caters for this demand and I am pleased to note that in all their advertisements they stress that any such wiring should be carried out by a competent electrician. This is the reason lanterns are only supplied through recognised electrical channels. A floodlight especially designed for export was particularly interesting as it had not only been designed to do a good job but also to pack easily, for space is money where exports are concerned.

Falk Stadelmann had their fine fittings very well displayed. Their illuminated ceiling units are too numerous to describe here, but, by using various units, a really good installation can be obtained. They also market floor-warming equipment, which I have "seen" in action, and, of course, their Snapfast switch must now be one of the best-known in the industry—and rightly so, in my opinion. It is interesting to note that this firm is very actively engaged in brightening up our railway stations, and a good job they are doing of it, too.

Of course, the AEI group's display took quite some time to tour and their exhibits were too numerous to describe individually. I was, however, interested in their "Reguplug" which is, briefly, a three-pin plug with a built-in Simmerstat, and it is fitted to the flexible lead of an appliance and varies the energy input to any electrical heating apparatus. It should not be confused with a thermostat as it does not operate in relation to the surrounding temperature. I have a Reguplug in use in my house and I can now use my glue-pot with ease and without having to keep one eye on it all the time. Of course, I have arranged the Reguplug in such a way that I can use it on fires if required. This, in my considered opinion, is a most useful accessory to have in the house.

These, then, are some recollections of a few crowded hours at Earls Court; although I realise that another visitor could have found as much to interest him, all on other stands. Next week the Editor hopes to find me space for an extra appearance to tell more of the story.

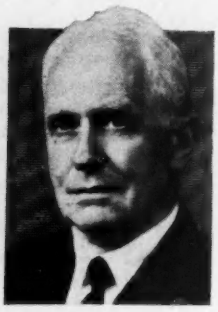
Personalities *in the industry*

Dr A. C. Robb

Mr N. E. N. Plahn

Mr S. E. Dvorjetz

Mr G. Powers



Mr J. R. Beard

Previously chief engineer to Aron Electricity Meter Ltd., **Dr A. C. Robb,** M.ENG., PH.D., A.M.I.E.E., has been appointed technical manager to Belling and Lee Ltd. Dr Robb graduated at Liverpool University and obtained a Master's Degree for post-graduate work. Subsequently he was awarded a Research Fellowship at Glasgow University to work on the design and commissioning of high voltage particle accelerators, and gained his Ph.D. for related studies. He was with the Ministry of Supply from 1942 to 1946, when he joined Standard Telephones and Cables Ltd., but in 1948 he became a member of the Glasgow University staff where he served until 1956.

Mr N. E. N. Plahn, managing director of Fuller Electric Ltd., has been appointed to the board of Hawker Siddeley Industries Ltd. Born in Sweden, Mr Plahn started his business career with the Swedish Spitzbergen Coal Mining Co., after a short period in Swedish Government service. He came to this country in 1927 and joined Fuller Electric as chief accountant and secretary. He was appointed a director of the company in 1932 and managing director in 1955. A Swedish knighthood, R.V.O. 1st class, was conferred on Mr. Plahn in 1947.

Senior assistant divisional chemist of the Southern Division, CEGB, **Mr J. Anderson** has been seconded to the CEB of Malaya for two years as senior chemist to the Board. He flew to Kuala Lumpur last week-end.

Mr B. G. Neden, ASSOCIATE I.E.E., service manager at Cambridge to the Eastern Electricity Board, has been appointed district manager-designate at Aylesbury, as from 1 May, and will succeed **Mr F. Bent,** M.I.E.E., A.M.I.MECH.E., who retires in June (*ESH, page 106). Mr Neden gained early training with the Beds, Cambs and Hunts Electricity Co., with whom he was resident manager at Huntingdon and St. Ives from 1939 to 1946. He then served at St. Neots and, in 1949, was appointed commercial engineer in the Cambridge district of the Eastern Electricity Board, and from 1953 to 1959 was senior assistant engineer in the Fens sub-area.

The board of directors of the newly formed Telcon Plastics Ltd. will comprise: **Mr W. C. Smith,** F.I.R.I., A.M.C.T., as chairman; **Mr J. L. Fergus,** A.H.W.C., A.R.I.C., as general manager; **Mr D. Norman-Thomas,** T.D., F.C.A.; and **Mr H. F. Wilson,** B.SC., A.R.I.C., A.I.R.I., COMPANION I.E.E., F.P.I., with **Mr L. G. F. Sliney** as the company secretary. As we noted last week, this new concern has taken over the activities of the former Plastics Division of the Telegraph Construction and Maintenance Co. Ltd.

Mr S. E. Dvorjetz has been appointed sales manager of Santon Ltd. to assist the company's sales director, Mr J. F. Ford. Mr Dvorjetz has been manager of the Birmingham branch for the past 12 years, having joined the company in 1946 as a representative in London. Prior to the war he was with the Woking Electricity Supply Co. The new manager of the Birmingham branch is **Mr G. Powers,** who was previously the company's representative in that area and has had considerable experience in both the heating and switchgear spheres of the company's activities.

Mr C. E. Harper has ceased to be managing director of Harper Engineering and Electronics and its subsidiary companies, but retains his seat on the board. **Mr E. M. Morris** has been temporarily appointed acting managing director.

District engineer at Exeter to the South Western Electricity Board since 1950, **Mr D. R. Beckett,** A.M.I.E.E., retired at the end of March after nearly 44 years' service with the electricity supply industry there. He started with the Corporation undertaking in July, 1917, and, after war service, held successive appointments, becoming mains superintendent in 1939 (*ESH, page 102).

The Institution of Mechanical Engineers have awarded the 1960 James Clayton prize to **Dr W. K. Wilson,** M.SC., D.SC.(ENG.), PH.D., WH.EX., M.I.MECH.E., for his contributions to mechanical engineering science, particularly in regard to torsional vibration and gyroscopic load of gas turbine rotors. Dr Wilson has been chief research engineer to the de Havilland Engine Co. since 1941.

The Electrical Research Association announces that **Mr James R. Beard,** C.B.E., M.SC., M.I.E.E., senior partner in Merz and McLellan, is to be president for 1961-62, and takes up office following the annual general meeting on 3 May. Educated at Manchester Grammar School and the University of Manchester, he received his early training with the North Eastern Electricity Supply Co. and the Cleveland and Durham Electric Power Co. before joining Merz and McLellan. Mr Beard was closely associated with the design and construction of the national grid system and the Scottish hydro-electric projects, and numerous electric power supply and traction schemes in this country and overseas. He has held many offices in learned societies, institutions and other organisations, being president of the IEE 1940-41, and subsequently being elected an honorary member. He was also president of the British Electrical Power Convention, 1953-54; chairman of the Association of Consulting Engineers, 1945-46; president of the ASEE, 1937-39; chairman of the Council for Codes of Practice for Buildings, Construction and

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* *Denotes revision to the "Electricity Supply Handbook, 1960."*

Engineering Services, 1947-49; chairman of various committees of the BSI and of the Electrical Research Association; and a member of the Engineering Advisory Committee of the War Cabinet, 1941-45. Mr Beard has also presented many papers on electricity generation, transmission and distribution before the IEE, the World Power Conference, CIGRE and other societies.

Mr J. R. Edwards, managing director of the Pressed Steel Co. Ltd., has been elected a vice-president of the Institution of Works Managers.

Formerly secretary to the Richmond (Surrey) Electric Light and Power Co., **Mr A. B. Meadows** has been chosen as mayor of Richmond for 1961-62. He was with the L and P Co. for 33 years before retiring in 1947, and has been a councillor for several years.

Mr H. W. G. Hignett and **Mr J. M. Dhavernas** have been appointed directors of the International Nickel Co. (Mond) Ltd. Mr Hignett remains managing director of Henry Wiggin and Co. Ltd. Mr Dhavernas is located in Paris and has been closely concerned for many years with nickel markets on the Continent.

Mr H. J. Penn has been appointed chairman of Murex Ltd. and of Murex Welding Processes Ltd.; **Mr F. W. Tomlinson** has become deputy chairman of both companies. **Mr H. C. Green** has been appointed managing director of Murex, and **Mr J. M. Willey** managing director of Murex Welding Processes. The appointments have been made following the recent death of Sir Arthur Smout.

Deputy station superintendent at Elland power station, Yorkshire Division, CEGB, since 1959, **Mr H. W. Golding,** A.M.I.MECH.E., has been appointed station superintendent of the Ffestiniog pumped-storage power station in North Wales, as from 1 April. (*ESH, page 75.) Educated at Rutherford Technical College, Newcastle upon Tyne, Mr Golding served his apprenticeship with C. A. Parsons and Co. Ltd. at their Heaton works on all aspects of turbine manufacture, erection and testing, and from 1944 to 1948 was employed in their drawing office. In 1948 he transferred to Deptford West power station as efficiency engineer and was later appointed assistant charge engineer, then charge engineer, before going to Huddersfield power station in 1957 as deputy station superintendent. He took a similar post at Elland in 1959.

Mr E. S. Ahl, A.M.BRIT.I.R.E., engineer-in-charge of the BBC Penmon and Llanddona sound transmitting stations, has been appointed engineer-in-charge also of the BBC Bangor studios in succession to **Mr S. Hett,** who is retiring after 37 years' service. Mr Hett joined the then British Broadcasting Co. in 1924 as an assistant maintenance engineer at Leeds, becoming engineer-in-charge of that station in 1931 and of the Newcastle studios in 1935. He became engineer-in-charge of the Bangor studios later in 1935. Mr Ahl joined the BBC in 1936 as an assistant maintenance engineer at the Brookmans Park transmitting station. He has served at a number of the BBC's transmitting stations and was appointed engineer-in-charge of the Penmon and Llanddona stations in 1958.

General manager and engineer of St. Helens Corporation Transport Department for the past eight years, **Mr J. C. Wake** has been selected for the position of transport manager to Bradford Corporation.

Mr R. D. Thomas, D.P.A., F.C.I.S., whose appointment as establishments officer to the Merseyside and North Wales Electricity Board we briefly noted last week, succeeds **Mr E. A. E. Colter** who recently relinquished the position on medical advice. Mr Thomas, who has been secretary of the Board's No. 3 sub-area since 1948, was educated at Birkenhead Institute Grammar School and Liverpool University. He had pre-war secretarial and financial service with Caernarvon Corporation and the West Cheshire Water Board. After war service with the RNVR he returned to the latter Board as clerk and accountant, and was concerned with the post-war development and reorganisation of that Board prior to joining MANWEB in 1948. Mr Thomas has been an Association's member of the National Joint Managerial and Higher Executive Grades Committee for the electricity supply industry since its inception and an employers' member, appointed by the Ministry of Pensions and National Insurance, on Local Insurance Tribunals in the Wirral. He is a vice-president and former chairman of the Liverpool and District branch of the Chartered Institute of Secretaries.

Mr F. H. McCrea retired as managing director of Dubilier Condenser Co. (1925) on 1 April. He continues as chairman and senior executive director. **Mr J. Goodman** and **Mr J. H. Cotton,** M.B.E., have been appointed joint managing directors.

Dr John Lamb, D.SC., A.M.I.E.E., F.INST.P., assistant director of the Department of Electrical Engineering in the Imperial College of Science and Technology since 1958, has been appointed to the James Watt Chair of Electrical Engineering at Glasgow University, in succession to the late Prof Hague. He will take up his new duties in September. Educated at Accrington Grammar School and the University of Manchester, where he graduated in 1943 with first-class honours in electrical engineering, Dr Lamb worked from 1943-46 with a research team in Manchester under the direction of Sir Willis Jackson for the Ministry of Supply. He then joined the staff of the Electrical Engineering Department in the Imperial College of Science and Technology, holding successive appointments as assistant lecturer, lecturer and reader. In 1958 he became assistant director of the department. Dr Lamb's research activities have ranged between electrical engineering, physical chemistry, mechanical engineering and physics. He has been particularly concerned with the application of electrical methods and techniques to the solution of problems in these related fields. In recent years he has initiated work on the measurement by electrical methods of the viscosity of liquids, a subject bearing on the practical problems of lubrication in high-speed gears. He is the author or joint author of numerous papers on these and related topics.

Dr H. G. Taylor, D.SC.(ENG.), D.I.C., F.INST.P., M.I.E.E., director of the Electrical Research Association, is visiting New York, Toronto and Montreal this month. In New York, he will attend the annual assembly of the International Institute of Welding from 11 April to 18 April. He is chairman of Commission No. III, which deals with resistance welding. Dr Taylor will then go on to Toronto and Montreal.

Mr H. Fletcher, A.M.I.E.E., has been promoted to district engineer, Leigh, to the North Western Electricity Board, in

Mr H. W. Golding

Mr R. D. Thomas

Dr J. Lamb

succession to **Mr R. Heys,** A.M.I.E.E., who recently transferred to the Board's No. 2 sub-area. Mr Fletcher was previously first assistant district engineer at Leigh. (*ESH, page 158.)

Mr St. John de H. Elstub, 45, has been appointed chairman of the Metals Division of Imperial Chemical Industries in succession to **Mr M. J. S. Clapham,** who has joined the company's main board as an overseas director. **Dr William H. G. Lake,** 45, has been appointed joint managing director (technical) of the Metals Division in succession to Mr Elstub.

After 41 years' service **Mr Charles Grad,** A.C.G.I., AEI University liaison officer and consultant to Associated Electrical Industries (Rugby) Ltd., retired at the end of March. Until the end of 1959 he was manager of the Education Department at Rugby. He has represented the company on a number of educational committees and has been a member of the Rugby College of Engineering Technology for many years. His early experience was gained in HM Dockyard, studying at Devonport Technical College, the Royal College of Science, London, and the City and Guilds Institute. He commenced a two-year apprenticeship with BTH, Rugby, in 1920 and was awarded a Fellowship. He subsequently held various positions in the motor factory, latterly as chief inspector, and in 1942 was appointed manager, Personnel and Training Departments. He later became the company's first Education Department manager, a position he relinquished at the end of 1959, when he was appointed to the position from which he has now retired.

President of the Dutch Philips organisation since 1939, **Mr P. F. S. Otten** has now retired from that position on reaching the age limit of 65. He joined the company in 1924. His successor is **Mr F. J. Philips.** Mr Otten succeeds the late Dr H. L. Wolterson as chairman of the Supervisory Board.

Formerly manager of the Traffic Department of Associated Electrical Industries Ltd., **Mr G. O. Pritchard,** M.INST.T., retired last week after 37 years' service. He relinquished the position of traffic manager last December, but remained in the service of the company as consultant. Mr Pritchard has been chairman of the Traffic Committees of AEI and BEAMA.

Mr W. W. Shaw-Zambra, C.V.O., C.B.E., T.D., retired on 31 March from the post of secretary general of the Commonwealth Telecommuncations Board. He is succeeded by **Mr W. Stubbs,** C.B.E., M.C., formerly director general of telecommunications, the Federation of Malaya and the State of Singapore.

The newly created Regional Electrical Department of the Midlands and East Midlands Region, CEGB, have appointed **Mr W. W. Smith,** B.SC., M.I.E.E., M.BRIT.I.R.E., regional electrical engineer; **Mr J. D. Pierce,** M.I.E.E., transmission project engineer; and **Dr L. B. Wood,** PH.D., B.ENG., A.M.I.E.E., technical and development engineer.

Mr Smith was educated at Nottingham University where he obtained a first class honours degree in electrical engineering in 1928 and was also awarded the Nadjeje prize for the most brilliant student in mechanical, civil and electrical engineering. His practical training was with the City of Birmingham Electricity Supply Department. In 1929, after a period as design engineer with Brush Electrical, he moved to GEC research laboratories at Witton and a year later to the Nechells Power Station. He joined CEB the following year as assistant engineer and in 1946 became a communication specialist at CEB headquarters. Since 1948 he has been technical engineer of the East Midlands Division.

Educated at Oxford High School, Mr Pierce received training with Oxford Electric Co. and gained further experience with the Wessex Electricity Co. In 1929 he joined the staff of the Central England Area CEB and in 1932 was transferred to the Nottingham Transmission Section where he was appointed section engineer two years later. When the East Midlands Division of BEA was formed in 1948 Mr Pierce was appointed senior assistant transmission engineer and was promoted to divisional transmission engineer in 1949. He was elected as an Associate Member of the IEE in 1936 and transferred to Member in 1955. Mr Pierce was elected chairman of the East Midland Centre IEE for the 1957/58 session.

Dr Wood, a native of Birkenhead, was educated at Birkenhead Institute and Liverpool University where he graduated in B.Eng. first class hons., in 1933 and Ph.D., two years later. In 1950 Dr Wood was appointed senior assistant technical engineer in the Midlands Division and held the post until 1959 when, one the merging of the transmission and technical departments, he became assistant divisional electrical engineer responsible for the transmission construction, development and technical sections.

OBITUARY

Mr F. W. Endicott, Scottish engineer to the BBC, at Glasgow, died on 21 March, aged 60.

Mr A. Sargent, a former works manager of British Insulated Callender's Cables Ltd. at Helsby, died on 24 March, aged 75. He retired in January, 1951, after serving his whole career in the cable-making industry. He started with W. T. Glover and Co. at Trafford Pk, where he became works manager and, in 1928, joined Macintosh Cable Co. at Derby. When those works closed in 1937 he took up duties with BICC at Helsby, where he became manager of rubber cables production, then works manager.

Mr E. Butterworth, A.C.A., director of labour and welfare, North West, Merseyside and North Wales Region of the CEGB, died on 23 March, aged 54. Before 1948, Mr Butterworth was clerk and treasurer with the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board and, on nationalisation of the electricity supply industry, he became divisional secretary of the Merseyside and North Wales Division of the then BEA, and it was in 1956 he became the Region's director of labour and welfare. (*ESH, page 73.)

Mr J. W. Hobday, a director of Baird and Tatlock Ltd., died on 29 March.

NEW LITERATURE

Applied Boolean Algebra

by Franz E. Hohn

IT is now more than a century since George Boole, the English professor of logic, first outlined the system of algebraic notation which bears his name. In recent years Boolean algebra has been adapted to electrical switching circuit design, particularly of the types of on-off multiple relay switching which is the basis of telephone, computer and allied circuits. Whereas normal algebra deals with mathematical *quantities*, the unknowns of which are represented by alphabetical symbols, Boolean algebra deals with the *abstract* alternatives of position, form, colour, state, etc. It follows that while the notations may be identical, the methods of treatment are widely different. This paper-backed textbook from the Illinois University attempts to give a brief introduction to the methods as applied to switching. For students and others who are concerned with modern electronic circuit design, it may be a useful entry into a world of symbolic logic which is proving valuable in the design of the more complex circuits of present-day electronic equipment. Published by Macmillan and Co., 139 pages, 9¼ in. by 5¾ in. Price 17s 6d.

BOOKS RECEIVED

First Course in Electromechanics, by H. H. Skilling. American text-book on electrical fundamentals with close reference to currently used machinery. Published by John Wiley and Sons Ltd., 350 pages, 9 in. by 5¾ in. Price 36s.

Fundamentals of Radio Receiver Servicing, by E. M. Squire. Introductory guide to practical guide of radio receivers. Published by Pitman, 172 pages, 7¼ in. by 4¼ in. Third edition. Price 15s.

Technical teacher training

FUNCTION OF THE TRAINING COLLEGES

by John A. Brown, B.Sc.(Eng.), A.C.G.I., D.I.C., Assoc.I.Mech.E.

THE training of technical teachers is a comparatively new venture. Before 1946, those prospective technical teachers who felt that training for a special job was desirable could only carry out such training as post-graduate students at a university department of education. Since such departments were mainly concerned with teaching in secondary schools, the special problems of teaching working adolescents and adults were outside the scope of their work. Technical teachers receiving training in this way did, of course, undertake general educational studies. They also studied general methods of teaching, but these they had to adapt and modify in the light of their experience as full-time teachers.

Non-graduates with technical qualifications had no channels along which they could travel for full-time, pre-service training, although short part-time courses of in-service training did exist.

Training Colleges

In 1946, the first of the technical teacher training colleges was founded. Now there are three, at London (Garnett College), Bolton and Huddersfield, with a fourth soon to be established at Wolverhampton. From the start, the work of these colleges has been geared to the needs of teachers in colleges of further education. The training provided varies to suit the special problems of teaching at all levels from the very elementary to the most advanced in engineering and other technologies, as well as the whole range of work to be found in the other departments of technical colleges. At first, the bulk of the work of the training colleges consisted of one year, full-time, pre-service courses. Staffs have, however, always played a large role in the short courses for serving teachers organised by the Ministry of Education, regional councils, universities and other educational bodies, as well as in courses organised by industry and industrial organisations for training personnel.

Day and Block-release Courses

In addition, Garnett College has been operating a day-release system for serving teachers for quite a number of years. Following the publication of the report of the Special Committee set up by the Minister of Education to consider the supply and training of teachers for technical colleges (the "Willis Jackson Report"), a scheme of block-release courses, each of ten weeks' duration, was started at the three colleges and in Wolverhampton in the summer of 1959. The courses were repeated in 1960. These two types of courses have been established for the benefit of men and women who have entered the teaching profession direct from industry and commerce without any training as teachers. They have proved very successful, work being limited only by the present accommodation at the colleges.

In all courses there is ample evidence that, in the words of the report: "A knowledge of the subject to be taught is essential, but it is far from being the only requirement; techniques of teaching and of class management are not mechanical routines which can be acquired without an understanding of the principles upon which they are based."

The report recommended that for serving teachers the block-release type of course was very desirable, with such teachers attending the colleges for three separate terms, each in succeeding years, to give the equivalent of the one year, pre-service course. This recommendation has not yet, however, been implemented.

Thus it is clear that there are three possible ways in which staffs of technical colleges can be built up to cater for the large increase in students being planned over the next decade.

First, men and women may be appointed directly from industry and commerce; some of these may take the one day per week course, the one term, full-time course or, occasionally, be seconded for a one year course.

Secondly, there are the increasing numbers of men and women who undertake a course of training before entering the profession, usually at one of the technical training colleges but also, in some cases, in one of the university departments of education.

Thirdly, there are those teachers with either graduate qualifications or normal teacher training who transfer to technical colleges after teaching for some time in secondary schools. The pressing problem is whether the numbers entering technical colleges through all channels during the next few crucial years will be adequate.

Electrical Engineering Needs

If we reduce the scope of this survey to electrical engineering in all its branches, we shall perhaps see the magnitude of the task more clearly. It has recently been estimated that the total of full-time electrical engineering teachers will have to be increased by more than 50% by 1963. This represents an increase of over 800 teachers. Where will this increase come from? Can the technical training colleges meet the demand both for pre-service and in-service courses?

Filling the teaching cavity—to meet the technical bulge

By 1963, 800 more full-time teachers will be needed to teach electrical engineering alone—an increase of more than 50%. Where will these teachers come from? How will they be trained? and, most important, what is there to attract them to technical teaching as a vocation?

In this article, Mr J. A. Brown, who is Principal Lecturer in charge of Engineering at Garnett College, outlines the function of the teachers' training college, in providing the answers to these questions.

Even when the present building programmes for these colleges are completed there will be other limitations to the number of electrical engineers entering teaching. As quoted earlier in this article, "A knowledge of the subject to be taught is essential, ——," and the training colleges, in consultation with the Ministry of Education, have established certain minimum requirements for acceptance for training. These are that the entrants shall have a University Degree, a Diploma of Technology, a Higher National Certificate or Diploma, a Full Technological Certificate of the City and Guilds of London Institute, or corporate membership of the Institution of Electrical Engineers. In addition, the minimum age of entry is 25, so that they shall have had reasonable experience in industry. These two factors together do not show fitness to teach and the training colleges have the added responsibility of determining such fitness. Each college has its own techniques. At Garnett College, candidates are invited to spend a day in the college in groups of about 16. During the morning there are a number of activities, the results of which are available to the members of an interviewing board before which the candidates appear during the afternoon. The board finally recommends acceptance or rejection. If a candidate is accepted, then the machinery for offering a place, checking medical fitness and determining maintenance grants is set in motion. All the colleges take very seriously their responsibility for selecting, as far as is possible, only those men and women who appear best fitted to the exacting task of teaching. They also appreciate their duty to the candidates to prevent those who would not be happy in teaching from taking the fateful step in that direction.

Financial Aspects

A very real problem in recruitment is the financial loss that many candidates face both during the training year and in the first few years of teaching. Exact figures cannot, of course, be given but it is estimated that a reasonable average of the salaries earned before training is about £900 per annum. The average of the maintenance grants for student teachers and their families during training is about £450 free of tax. From this total possibly anything up to, and in many cases in excess of, £200 is earmarked to meet standing commitments such as rents, mortgages, insurances, etc. The average starting salary for such people in teaching is probably about £900 per annum, although after a relatively short time the new teacher can expect to earn considerably more. It must be obvious, therefore, that candidates who, after considering all these things, accept places in the colleges must have some sense of vocation and this we find is the case. This, too, is probably why, to quote the Willis Jackson Report again, "—— From the evidence submitted to us, it is clear that technical colleges generally appreciate the presence on their staffs of teachers who have been trained at the technical training colleges and that, other things being equal, they prefer them to untrained teachers."

The Training Course

Finally, what is the content of a full-time course at one of the training colleges? There are three main parts. The first covers educational studies such as the principles of education, history and administration of education—with special reference to technical education—and educational psychology. The second part covers study of the techniques and methods of teaching with special reference to the students' own subjects. The third phase covers teaching practice carried out in technical colleges for a total of up to 12 weeks. This teaching practice is supervised both by the full-time teachers to whom the students are attached and by the staffs of the training colleges who visit all students as frequently as possible during the practice periods.

To these three main parts must be added such things as the further study of English in order to improve students' ability to express themselves clearly and correctly in written and spoken English, the study of the social and industrial backgrounds of students in further education, and all those activities, both formal and informal, which enrich the individual and help him to play a full part in the life of any community.

It has never been claimed that a year spent in one of the training colleges is enough to make a man into a teacher, but all those engaged in training firmly believe that such a course reduces the time necessary to become a really competent teacher and makes the process much more efficient and less painful. It must surely be conceded that students in the technical colleges benefit from having teachers who, when they start, have already acquired basic techniques of man-management and presentation and have some understanding of the real meaning of education.

Electrical Models and Analogues

THE value of electrical models and analogues as an aid to the appreciation of a given problem was the subject of an address by Prof E. Bradshaw, to the Manchester Society of Engineers, recently.

Prof Bradshaw first drew the distinction between a model, which implied primarily a change of scale; such as the hydraulic model of a tidal channel, and an analogue which implied a change of the medium used. In a direct analogue, elements in the original and analogue systems have comparable behaviour. For example, mechanical systems can be represented electrically in such a way that all forces are represented by voltages. Alternatively, in the indirect analogue, the behaviour accords with a mathematical formulation of the behaviour of the original system. Elements in the analogue do not then necessarily represent elements in the original system but rather mathematical operators in equations.

The main advantage of electrical analogue representation of a given system is, generally, the improved facilities afforded by the analogue for investigation and measurement. In the analogue, a range of operating conditions is usually more easily varied than in the original system.

Analogue methods seldom allow computation accuracy to better than 0.1% and to achieve even this figure usually involves considerable effort and cost. More commonly between 0.5 and 2% is possible. Although digital computers can operate with almost any required accuracy, since in engineering problems much data is often only approximate, high accuracy is not of real value. It should be noted that the analogue is relatively cheap compared with digital computer techniques. It also gives a "feel" of the engineering aspects of the problem, which in turn enables the operator to develop an engineering sense for making decisions about the relative significance of the different parameters and variables involved.

Increased complexity of a physical system, although it increases the number of analogue elements, does not necessarily require increased computation time. This, however, is not the case with digital methods.

STANDARDISATION PROGRESS

BRITISH STANDARDS . . . INTERNATIONAL RECOMMENDATIONS . . . INDUSTRY CODES

STRICTER testing is a requirement for capacitors for fluorescent lamps, included in a revision of BS 2818:Part 2, *Auxiliaries for Operation of Fluorescent Lamps—Capacitors.* The new specification also extends its scope beyond the 80 W, 5 ft tubes to which its 1957 predecessor was limited; capacitors up to 20 microfarad for all types of tubular fluorescent lamps to BS 1853 are now covered.

Capacitors made to the standard are suitable for continuous operation either in series or shunt. Paper dielectric capacitors are specifically covered, but the specification is intended to act as a guide for the testing and acceptance of non-standard capacitors.

As a result of the extended scope of the standard, preferred capacitance values are now listed for 5 ft 80 W lamps (changed from the earlier value), 2 ft 20 W, 2 ft 40 W, 3 ft 30 W and 4 ft 40 W; values for 8 ft 125 W are under consideration.

Included in the specification is a discussion of the use of fuses in fluorescent lamp circuits, additional to the normal circuit fuses. At the request of the purchaser, a fuse may be fitted inside the container of a shunt capacitor. A note to the standard stresses the disadvantage of fitting internal fuses, notably the lack of indication as to whether power factor correction has been lost, and consequent possibility of sharp increase in current.

Test requirements now laid on manufacturers include type tests, sampling tests, routine tests and "quality maintenance tests." These last consist in repeating type tests at intervals of about 12 months during long production runs; and if production is stopped for more than 18 months. Sampling tests, a new feature of the standard, are based on taking sample capacitors from batches of about 5,000, and checking them for insulation resistance and thermal stability; they will have been tested for dielectric and insulation strength, capacitance value and freedom from compound leakage at over-temperature as part of the routine testing.

Because the new standard represents a higher test level than the old, the year (1961) as well as the standard number must be marked on capacitors.

New Standards Projects

TUNGSTEN filament lamps for purposes other than general service are dealt with in BS 555, which is now undergoing revision. Aim of the committee revising the standard is to bring in formulae, tests and other requirements to align closely with those of BS 161, on tungsten filament general service lamps. Requirements to be written into the standard will relate to the testing of a batch of lamps only, not to the whole product of a manufacturer. Amongst other BS standards now being revised is BS 18, on the tensile testing of metals; and, as a result of this, the primary standard test piece is likely to be altered from its present form. The revision is to take account of ISO recommendations. Another ISO activity introducing new work is a meeting to be held at Geneva between various international standards organisations to study standardisation in the field of digital computers and data processing machines.

LAMP STANDARDS

TWO recently published standards deal with lamps. They are BS 469 : 1960, *Electric Lamps for Railway Signalling,* and BS 1075:1961, *Studio Spotlight Lamps.* Both are revisions. The new BS 469 gives a list of lamps reckoned as suitable for meeting present and future requirements. Statistical methods of test and inspection are introduced to escape the uneconomic alternative of testing every lamp in a batch.

The change in BS 1075 is that it now recognises two classes of lamps, one for black and white photography and television, the other for colour photography and television. There are a number of other alterations, including recognition of two rated voltages and inclusion of new lamp ratings. The ratings covered range from 500 W to 10 kW, and overall dimensions for lamps are laid down.

RUBBER PLUGS

PLUG bodies moulded in rubber or some other resilient material are considered advantageous by some engineers, because of the reduced risk of breaking the body through rough treatment. To bring this preference within the scope of standardisation, BSI issued recently supplements to two existing specifications. One deals with plugs to BS 546, the other with plugs to BS 1363.

Rubber used for plug bodies is required to have a hardness not less than 85 British Standard degrees when tested at 20°C ambient temperature. Design has to be such that deformation of the body to give access to live parts is not readily possible; and separated metal parts cannot be brought into contact with one another. A test is specified to check the possibility of forcing the plug pins into sockets other than those for which they are designed. This takes the form of measurement of deflection under mechanical load, with two of the pins fixed. Plugs complying with the requirements of the supplements are to be marked BS 546/A and BS 1363/A, respectively.

Creep Strength of Steel

PROCEDURE for determining the creep strength of steel at high temperatures is laid down in BS 3228 : Pt. 3 : 1960, *Properties of Steel, Creep Strength.* The standard concerns itself with selection of samples and their subsequent treatment and the spread of tests, with the purpose of producing representative results.

N.C.B. INSULATION MATERIALS

CONDUIT, lamps, and plugs and sockets figure in recent additions to the list of NCB specifications; and also to be noted are additional requirements for some types of cable. The conduit specification 242/1961, *Steel Conduit and Fittings for Electrical Wiring,* restricts the purchases of conduit by the NCB to heavy gauge screwed conduit to Class B of Table 1 of BS 31.

Conduit fittings are accordingly to be of the screwed type. Three types of small circular boxes are standardised.

Specification 239/1961, *Bayonet Lampcaps and Lampholders,* selects certain types from BS 52 for NCB use; and 232/1960, *Edison Type Screw Lampcaps and Lampholders,* similarly requires compliance with BS 98, and adopts the five sizes given in that standard. A footnote permits use of the "small" size, for which normal maximum voltage is 130, in a circuit operating at 250 V, provided the circuit is not normally liable to be touched, as when being used as a signal lamp in electronics apparatus.

Specifications 233/1960 and 230/1960 deal with 13 A fused plugs and socket-outlets and two-pin side-entry wall plugs and sockets, respectively. In 233, the requirements of BS 1363 are extended by a provision that the earthing socket has to be bonded to the back of the outlet box by a metal link, or made with a terminal to receive an earthing conductor as for line and neutral sockets. In 230, BS 372 is adopted entirely, but standard ratings of 2 A, 5 A, 15 A and 20 A are laid down.

The cable specification modifications mentioned apply to armoured cables for power supply. (Amendment No. 1 to P.139/1957, and amendment No. 1 to 202/1960.) Where cables are sheathed with p.v.c., the sheath is required to be embossed with the words "Electric Cable" followed by the rated voltage for which the cable is designed. Minimum sizes are laid down for the letters and numbers involved and a gap of 6 in. must not be exceeded between one embossed group and the next.

new products and appliances

Versatile lighting fittings

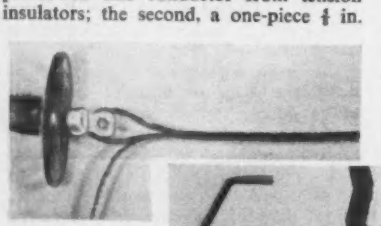
A VERSATILE range of lighting fittings which can be assembled from a relatively small number of components is being launched by General Electric on 1 May. The range, called "Executive," consists of single pendant fittings which may be varied by the addition of a large selection of glassware together with reflectors and metal or Perspex decorative skirts. Silver anodised aluminium suspension tubes ½ in. dia are in lengths from 9 in. to 36 in. and have earthing terminals at the top. The satin etched, white flashed-opal glassware comes in four basic shapes each in several sizes. Stove enamelled spun aluminium reflectors are white on the interior and sage green on the exterior and the decorative skirts are either of aluminium, stove enamelled in deep turquoise on the outside and white inside or Perspex, in translucent terracotta or clear smoke blue. Prices, which include glass, canopy, lampholder and suspension, will be in an approximate range from 50s to £8 per fitting. *General Electric, Magnet Hse, Kingsway, W.C.2.*

Shorted-turns tester

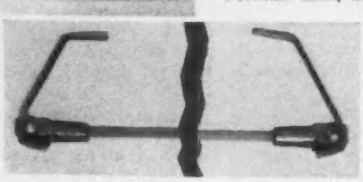
A PORTABLE device for detecting shorted turns in transformer, choke, solenoid and similar windings, consists of a transistorised oscillator unit incorporating an indicating meter and sensitivity controls. It is used in conjunction with one of three sizes of probe, the sensitivity control being adjusted to give optimum performance for different coil sizes. Cost of the equipment, complete with a set of three probes, is £26. *Spembly Ltd., New Road Ave, Chatham, Kent.*

Preformed wire fittings

FOR use in conjunction with preformed wire "Guy Grip" terminations for overhead lines, are two galvanised iron accessories recently announced. The first is a socket-thimble for making-off preformed line conductor from tension insulators; the second, a one-piece ½ in. dia stayrod, having no turnbuckle, and incorporating a terminating thimble at one end. Preformed wire fittings are said to simplify line erection and to be cheaper than conventional types on the market. *Preformed Line Products (Great Britain) Ltd., Andover, Hants.*



▲ *Preformed wire "Guy Grip" termination for o.h. conductor*



◀ *Permali bonded fibreglass staywire insulator*

Price reduction

COURTNEY, POPE (Electrical) have reduced the prices of two of their fittings, the TI.39 and TI.14, the former is a pendant spotlamp and the latter a semi-recessed fitting. The TI.39 has been reduced from £3 9s to £2 12s 6d and reductions for the TI.14 with former prices in brackets are: long, £5 12s 6d (£6 15s 3d); medium, £4 15s (£6 5s 3d); short, £3 15s (£5 14s). *Courtney, Pope (Electrical) Ltd., Amhurst Park Wks, Tottenham, N.15.*

2 kW fan heater

A 2 kW fan heater which uses the tangential flow principle will be shown in May by Gatehill Beco. The price has not yet been fixed, but it is stated to be competitive. It is claimed by the manufacturers to be the first all-British fan heater/cooler, although the company have retained leading Continental as well as British designers to create the most suitable styling. The tangential flow projects a jet of hot or cold air up to 15 ft before it is dissipated by convection, and the unit is comparatively silent. This is the first of five new appliances which Gatehill Beco are launching this year. *Gatehill Beco Ltd., Stratford, E.15.*

Bonded glass fibre stay-insulator

HIGH mechanical strength combined with lightness and design simplicity are advantages claimed for "Permaglass" staywire insulators now in production. Suitable for ½ s.w.g. staywire, each insulator comprises a length of ½ in. dia resin-bonded glass fibre rod having a clevis-ended galvanised iron terminating fitting clamped to each end by means of a self-locking collet. Staywire is made-off by passing it round a thimble, which is then inserted into the clevis and retained by the bolt end of the arcing horn. Electrical characteristics of the insulator are said to be equivalent to those of the original "Permali" type. *Permali Ltd., Bristol Rd, Gloucester.*

Miniature pressure switch

RECENTLY announced is a miniature pressure switch suitable for use with non-corrosive liquids and gases in situations where space is limited. It incorporates snap-action silver contacts rated for up to 5 A at 250 V a.c. and 1·5 A at 30 V d.c. inductive, and housed under a grey hammer finished aluminium cover. The operating bellows are of seamless phosphor bronze contained in a nickel-plated brass body having a pressure connection threaded to ¼ in. or ½ in. B.S.P. Nominal contact operating pressure can be adjusted within certain limits, a choice of three ranges being available. A typical specification is: maximum pressure 300 p.s.i., adjustable operating range 15 p.s.i. to 80 p.s.i., with a corresponding reset differential of 3 p.s.i. to 5 p.s.i. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

Stretchable heating cable

BUTYL rubber is used to insulate a spiral wire in a cable for use in floor-warming installations which has been developed by the Invisible Panel Warming Association (patent pending). The principal advantage claimed for the cable is that both the wire and the insulation stretch relatively easily and so they are able to take up the effects of opening contraction joints or shrinking concrete more easily than the usual straight heating wire in p.v.c. insulation. The greater heat release area of the cable also has advantages in permitting a higher loading/ft of cable run and, hence, wider spacing of cables for given heat output/sq ft of heated floor. Butyl rubber is reckoned to be suitable for continuous operation at 195°F. From the installation aspect, the relative ruggedness of the cable reduces the danger of serious damage before it is covered by screeding. *Sterling Cable Co. Ltd., Aldermaston, Berks.*

Armoured plug and socket couplers

SECURE and reliable electrical connection is claimed for the "Hubbellock" range of armoured, self-locking plugs and sockets and couplers. Ruggedly constructed for heavy-duty portable equipment applications, plug and socket components are locked in contact by pressing together and rotating relative to one another. Rated at 20 A, 250 V d.c. or 30 A, 600 V a.c., the components incorporate a safety shutter which excludes dust and foreign particles and helps to confine arcing on separation. The range of accessories available includes also male sockets and female plugs. *Harvey Hubbell Ltd., Knoll Rd, Camberley, Surrey.*

◀ *"Hubbellock" male socket*

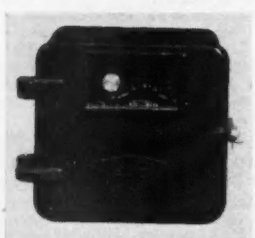
and female coupler

Seven-day time switch

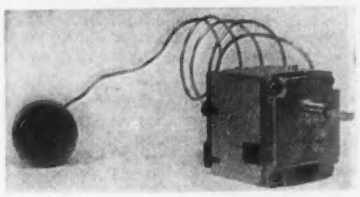
DESIGNED primarily for the control of space heating, the Horstmann "Timestat" can be used in conjunction with standard controls systems to programme electric, gas, oil or solid-fuel heating. It has been made to meet the demands of time switch specifications calling for irregular and complex switching schedules. The unit, fitted with a seven-day dial, consists of a movement making one revolution a week. Each day of the week can be individually programmed to the exact switching requirements of that day and the alteration of a single day's programme may be achieved without disturbing the remainder of the week's schedule. An overriding on/off manual control is fitted, and as this operation is independent of dial operation the sequence remains unchanged when control is returned to automatic. The "Timestat" is available with either synchronous or electrically wound clockwork movements and also synchronous movements with spring reserve. It is fitted into an aluminium box, the cover fastening with a cam latch which can be locked and sealed. Two models are at present on the market, a 5 A and a 20 A, both a.c. *Hortsmann Gear Co. Ltd., Newbridge Wks, Bath, Somerset.*

Thermostat control for hot plates

WITH the growing popularity of thermostatically controlled hotplates on semi-luxury class cookers, AEI Instrument Division have introduced the Sunvic "Panostat," type THP. It has two main components: the switch head which can be located anywhere on the cooker, and the sensing head, which is in contact with the base of the pan, giving sensitive temperature control. These are connected by an oil-filled capillary tube. The hydraulic sensing unit is situated in the centre of the hotplate and it is suitably sprung so that a rigid oil-filled capsule is in close contact with the base of the pan. A rise in the temperature of the pan's contents is sensed through the base and this causes the oil in the capsule to expand. This expansion is transmitted via the capillary tube to a flexible diaphragm in the switch head and the motion is communicated to the microswitch by a proportioning device. The heat energy supplied to the hotplate is regulated by the fluctuations in temperature of the contents of the pan. *AEI Instrumentation Division, Harlow, Essex.*



Seven-day time switch by Horstmann



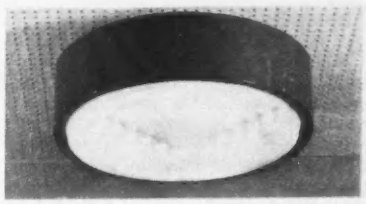
Sunvic's "Panostat" gives temperature control

Flex extension

DESIGNED to alleviate the problem of the too short flex, Marbourn have introduced a flex assembly. It has a 13 A flat pin plug at one end to connect with the socket-outlet and a shuttered outlet at the other. Three yards of three-core v.r.i. cable connect the two and the extension is thus achieved. The cost is 16s 9d. *Marbourn Ltd., Roslyn Rd, South Tottenham, N.15.*

Drum-shaped lighting fittings

A RANGE of drum-shaped lighting fittings are shortly to be released by Merchant Adventurers. These will be available from 5 in. to 18 in. dia for 40 W to 200 W lamps and they can be fixed individually or in groups of up to nine lights. Wall brackets are also available. A feature of these fittings is the diffusing louvre made of opal urea formaldehyde which has a high light transmission. The concentric design is claimed to give good downward illumination with cut-off of 45° to screen the lamp from normal viewing angles. The drums are finished in a variety of stove enamelled colours, and other metalwork and mountings are finished in satin silver. *Merchant Adventurers Ltd., Hanworth Estate, Hampton Rd West, Feltham, Middx.*



One of the range of new fittings by Merchant Adventurers

RECTIFIER DEVELOPMENTS

PROGRESS in the development of semiconductors continues to widen the choice of rectifiers available to industry. Thus, the recent announcement by the Westinghouse Brake and Signal Co. of up to 50% price reductions for their range of "Trinistor" silicon controlled rectifiers augurs well for the establishment of this device in medium power control applications. Backing this announcement, the company have now supplemented their existing "CS1" range of 25 A "Trinistors" covering voltages from 25 V to 400 V by a 16 A range, the "CS2." This is the first step in a programme to build up a complete size range to suit various requirements.

For straight rectification purposes, the International Rectifier Co. have introduced a new range of medium power silicon stacks. These have been designed to give power supplies for such equipment as power amplifiers, computers and radio transmitters. Available in single- and three-phase bridge configurations, the stacks have efficiencies of up to 98%, heat losses being dissipated by means of cooling fins. Main advantages claimed for these units is their compactness and rugged construction. Other features include colour coded terminals and a fully tropicalised finish.

Despite growth of competition from semiconductor devices, the gasfilled grid-controlled rectifier continues to give useful service. Steady improvements in the design of this type of device is manifest in the new "Ediswan 21B12" xenon-filled valve announced by AEI. This is intended for ignition control of welding equipment, motor control or simply as a straight rectifier with grid control. It employs a directly heated cathode, which coupled with the use of xenon gas filling reduces the warming-up period of the valve to 30 sec. To improve mechanical robustness and stability of electrical characteristics, disc-sealed construction has been adopted; this type of construction also reduces the risk of backfiring and increases valve life. Leading valve constants are: maximum forward voltage, 1 kV; peak inverse voltage, 1·25 kV; maximum cathode current, 30 A; mean cathode current, 2·5 A.

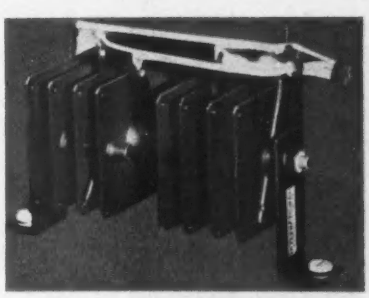
Westinghouse Brake and Signal Co., 82 York Way, N.1.

International Rectifier Co. (GB) Ltd., Hurst Green, Oxted, Surrey.

AEI Radio and Electronic Components Division, 155 Charing Cross Rd, W.C.2.

◀ Xenon-filled grid-controlled rectifier by AEI

International Rectifier Co's silicon rectifier stack ▶



Automatic lighting control

A NEW automatic lighting control unit comprises three separate, but interconnected components. The main switching function is performed by a three-phase 30 A contactor, which can handle up to 6,000 W of lighting load. This is controlled either by a photo-cell, having adjustable daylight setting, or a time switch which can be arranged to override the photocell if required. To suit daylight conditions of individual installations, a separate, waterproofed photocell is available which can be positioned to give optimum results. Price of the complete control unit is £19 19s. *Photoelectronics (MOM) Ltd., Oldfields Trading Estate, Oldfields Rd, Sutton, Surrey.*

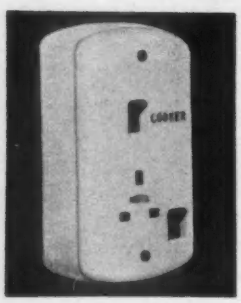
Contactless control

HEART of a control system which has been applied to the automatic emptying and handling of mine cars, is a combination of transistorised logic elements and contactless sensing devices from the "Unistat" range of "static" components. The great advantage claimed for the system is its reliability since it eliminates the use of relays and other devices employing mechanical contacts. The sequence of operation involves raising full cars to the surface by means of a cage winder, where they are conveyed up a slope to a wagon tippler. Their contents having been emptied, the cars are allowed to free-wheel back to the mine-head ready to be lowered underground again by the cage winder. The positions of cars at the various stages of the operation are detected by the sensing devices, which respond to the proximity of ferrous material. Signals from the sensing devices are fed to the logic elements responsible for the sequencing control. These in turn send out amplified signals to the various control solenoids, motor starters and contactors. *The English Electric Co., English Electric Hse, Strand, W.C.2.*

Cooker control unit

AVAILABLE for flush or surface mounting, the Nettle cooker control unit is supplied either with or without neon indicator lamps on both switch and socket positions. It comprises a main switch for the cooker and a 13 A socket-outlet for other kitchen appliances. The main switch is double pole a.c. rated at 45 A. Both switch operating dollies are manufactured in nylon which provides high strength with low friction characteristics. The surface mounting unit is priced at 20s and the flush mounted unit costs 18s. Neon indicator lights are an extra 9s.

Nettle are also producing a 13 A adaptor which is unfused and shuttered. It is small in size and sells at 66s/dozen. In addition to this there is a 15/13 A adaptor with two shuttered outlets which is finished in ivory and is priced at 77s/dozen. *Nettle Accessories, Harper Rd, Wythenshawe, Manchester 22.*



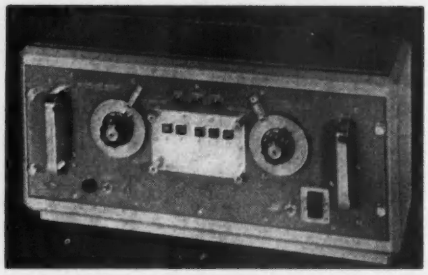
Nettle cooker-control unit with 13 A socket

Component inspection bridge

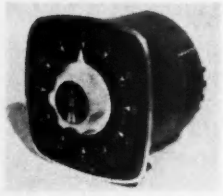
FOR routine factory inspection of electronic components, the "Comparatron Limit Bridge, Type 51" compares tolerance limits of resistors, capacitors and inductors against preset standards. Basically a universal impedance bridge, operating at 1,000 c/s, the instrument has two dials by means of which tolerance limits of up to ±25% can be set up in steps of 0·2%. Testing of components in any particular batch is carried out by simply placing each one across a pair of contacts. Indication as to whether the component is above, below or within the required tolerance limits is given by coloured lamps mounted on the facia. If required, the instrument can be readily adapted for automatic inspection by connecting to a reject mechanism circuit for which output facilities are incorporated. *Mec-Test Ltd., Henrietta Hse, Henrietta Pl, W.1.*

Automatic reset timer

A NEW synchronous motor-driven timer, the "PT5," combines a number of timing functions in a single unit. By making appropriate connections to the operating contact terminals the unit may be used as a time delay relay, a single operation process timer or a recycling process controller. A pointer mounted on the timer knob indicates unexpired time at any instant and on completion of any particular timing operation returns automatically to the preset time position ready for the next cycle. Time setting can be altered by simply rotating the knob until the pointer indicates the desired period. At the end of each cycle a pair of contacts is closed, and these can be used to initiate a second timer. Thus a group of timers may be interconnected to control a number of processes in preset sequence. All timer control contacts are rated at 10 A at 250 V or 5 A at 500 A a.c. *Venner Ltd., Kingston By-Pass, New Malden, Surrey.*



◀ *Comparatron bridge by Mec-Test aids routine component testing*



Venner automatic reset timer

TRADE PUBLICATIONS

E.E.—Brochure giving details of travelling wave tubes, their characteristics, installation and applications. Pamphlet with pictorial details of high-power klystron. English Electric Valve Co. Ltd., Chelmsford, Essex.

MIDLAND SILICONES.—Leaflets giving names of 40 suppliers of silicone electrical insulating materials and 53 silicone rubber processors. Midland Silicones Ltd., 68 Knightsbridge, S.W.1.

ENFIELD ROLLING MILLS.—Illustrated booklet of resistance welding electrode materials manufactured by Enfield Rolling Mills Ltd., Brimsdown, Enfield, Middx.

S.I.F.—Four leaflets giving details of welding materials. Suffolk Iron Foundry, Stowmarket, Suffolk.

BAYLISS JONES AND BAYLISS.—Attractively produced brochure illustrating selection of galvanised forgings and steelwork. Bayliss Jones and Bayliss Ltd., Victoria Wks, Wolverhampton.

CROMPTON PARKINSON.—New catalogue and price list giving reference to full range of commercial and display lighting for fluorescent and tungsten filament lamps. Crompton Parkinson, Aldwych, W.C.2.

HEAD WRIGHTSON.—Illustrated brochure giving details of electrostatic precipitation plant. Head Wrightson Ltd., Teesdale Iron Wks, Stockton-on-Tees, Co. Durham.

AIRCRAFT-MARINE.—Comprehensive catalogue of soling pre-insulated taper pins, moulded taper blocks and taper receptacles for miniature plugs. Aircraft-Marine Products, Safron Hill, E.C.1.

KENNAMETAL.—Catalogue of tungsten carbide products together with tool manual. Kennametal (Gt. Britain) Ltd., Coleshill St, Birmingham 4.

CRYPTON.—Leaflet describing electronic engine tester. Crypton Equipment Ltd., Bridgwater, Somerset.

BLACO.—New trade price-list of conduit fittings. F. C. Blackwell Ltd., Mushker St, Gt. Crosby, Liverpool 23.

FAWCETT.—Leaflet with specifications of resistors for steel works duty. Fawcett Preston Co. Ltd., Bromborough, Cheshire.

ELECTROMATIC SHOPBLINDS. — Brochure giving details of electrically operated shop blinds. Electromatic Shop Blinds Ltd., 201 Eade Rd, N.4.

MAGICOOK.—Details of Magicair Supreme fan heater in leaflet. Magicook Appliances Ltd., Carlton Vale, N.W.6.

CROMPTON PARKINSON. — Recently issued leaflets detailing advantages of high wattage lamps and fluorescent fittings by Crompton Parkinson Ltd., Crompton Hse, Aldwych, W.C.2.

A.E.I.—Leaflet on silicon rectifiers, transistors and silicon industrials. A.E.I. Radio and Electronic Divn, Charing Cross Rd, W.C.2.

AVO. — International Transistor Data Manual, giving details of 3,000 transistors, including obsolete, current and prototypes. Avo Ltd., Vauxhall Bridge Rd, S.W.1.

E.E.—Brochure illustrating activities and facilities of English Electric Valve Co., Chelmsford, Essex.

B.C.L.—Booklet on multi-packaging aid. British Cellophane Ltd., Henrietta Pl, W.1.

News of the Week

FEWER DOMESTIC ACCIDENTS

—*According to Home Office Statistics*

ENCOURAGING news on electrical accidents in the home comes in statistics issued by the electrical adviser to the Home Office. Fatalities due to electrical equipment fell from 78 in 1959 to 38 in 1960. There was an increase in what the list calls "miscellaneous" premises (not homes, not factories) from one to 11 fatalities. Industrial accidents show an increase from 73 to 85, but over all the total for the year is down at 134 fatalities compared with 153 in 1959.

The reduction in domestic electrical accidents seems spread over all types of appliances. It is notable in view of recent publicity that only one death was attributed to electric blankets compared with seven in 1959. There were sharp drops as well in accidents due to electric heaters, cables and flexibles.

FATAL ELECTRICAL ACCIDENTS, 1960

Domestic	
Electric heaters, radiators, etc., and fires (3 in bathrooms); (Children 2; 1 in bathroom)	8
Cables, flexibles, etc.	8
Radio, TV and gramophone sets and aerials (1 in bathroom)	2
Electric irons	3
Portable lamps	1
Electric kettles	2
Electric blankets	1
Vacuum cleaners	3
Electric drills and other tools	1
Electric hairdryer (1 child in bathroom)	1
Electric wash boilers and washing machines	6
Electric lawn mowers	1
Lampholders and pendant switches (1 child)	1
	38
Miscellaneous Premises	
Portable and other lamps	2
Electric tools (drills, etc.) (1 child)	4
Unclassified	5
	11
Factories—Portable and Transportable Apparatus	
Portable and transportable electrical machines, etc.	9
Portable heaters and irons	–
Portable lamps	3
Portable testing sets, including lamps, instruments, etc.	–
Plugs, sockets and adaptors	3
Cables and flex for portables	–
Electric hand welding	1
Factories—Fixed Apparatus	
Electrical machines	1
Transformers and reactors	–
Switchgear	7
Fusegear	–
Crane and other trolley wires, etc.	3
Fixed lamps	1
Cables and accessories for fixed apparatus	3
Test leads, test terminals, etc.	–
Overhead transmission and distribution lines	8
High frequency equipment	1
Not classified	1
	41
Miscellaneous Industrial Premises	
Cables, flexibles and accessories	6
Portable electric drills, handlamps, etc.	3
Miscellaneous	4
	13
Overhead Lines and Railways	
Live rails and trolley wires (railways, etc.) (children playing on railway track—9)	13
Overhead lines (children 2)	18
	31
Summary of Fatalities	
Domestic or similar character	49
Industrial or similar character	85
	134

G.E.C. Slashes Staff

MAJOR redundancy amongst all levels of staff within the GEC organisation has been reported. Some accounts speak of some hundreds of head office employees being dismissed, on a basis of a month's notice with one week's salary for every year of service. It appears that the full extent of the redundancy is not yet evident, and the company is making no statement about its full intentions at present. Indications are, however, that in some cases the staffs of departments are being reduced to low levels, or the departments closed down altogether.

Recently it was announced that the boards of GEC and Radio and Allied (Holdings), the Sobell concern, had agreed to recommend amalgamation of the two companies.

New Scale for Station Clerks

NEW provisions for the grading of power station clerks in the electricity supply industry were agreed at a meeting of the NJC last month. Back-dated to April, 1960, the new arrangement takes the number of employees as the main factor in determining the grading of each post, although MW capacity of the station is also to be taken into account. Previously, grading was rigidly fixed according to whether original records duties only, or records and accounting duties were dealt with.

The new provisions give an extra grade for each of the six classes, but the staff side of the NJC indicated that they considered the new arrangements might still be inadequate in some cases, including the nuclear stations.

LATEST HIGHLAND STATION

ONE of the highest power stations in the Highlands, Lednock hydro-electric station, Perthshire, has been put into service by the North of Scotland Hydro-Electric Board, thus completing the Breaclaich works in the Breadalbane scheme. Situated 1,160 ft above sea level, the 3,000 kW station stands on the shore of Loch Lednock, the reservoir formed in Glen Lednock by a dam five miles up the glen from Comrie village.

The station has a horizontal Francis turbine made by Harland Engineering operating on a gross head of 300 ft, driving a Bruce Peebles induction generator.

SALARY CLAIMS IN SUPPLY INDUSTRY

CLAIMS for upgrading of district managers and station superintendents in the electricity supply industry were considered at last month's meeting of the National Joint Managerial and Higher Executive Grades Committee. Although the boards' side saw no grounds for any change on the district managers' claim on the evidence submitted, the matter has been turned over to the standing committee for consideration.

On the station supers' claim the boards' side offered to apply Grade 6 instead of the present Grade 5 from Class "B" upwards without any variation for Class "A" superintendents. But this offer was not accepted by the staff side, who are to consider the question again.

But additional payments of £150 p.a. to certain headquarters officers of the South Western Electricity Board, whose responsibilities have been increased under the new set-up there, were agreed at the meeting. This arises from the earlier claim for parity with the London Electricity Board, which has also adopted two-tier organisation. Although the arbitrators rejected that claim, the plus payment recognises that some responsibilities, previously at sub-area level, have gone to certain headquarters officers. The staff side, however, are against plus payments in principle and sought a full additional grade to the schedule.

Hawker Siddeley quit Nuclear Research

GOVERNMENT indecision on nuclear propulsion and less spectacular developments in nuclear power generation than was originally expected have forced Hawker Siddeley Nuclear Power Co. into closing their factory at Langley, near Slough. This virtually amounts to a withdrawal from nuclear research, for the Langley factory carried out the group's long-term development of reactor designs for nuclear power generation, ship propulsion and process heat production. The shutdown will be effected progressively during the next few months and all outstanding commitments will be fulfilled. Some of the work may be transferred to other factories, but many of the 350 employees will be retrenched.

The decision does not affect the group's nuclear power factory at West Howe, Bournemouth, which employs 130 people, and is engaged on work under direct contract to the UKAEA.

One of the best-known developments carried out at Langley was the Jason industrial training reactor. Two had already been sold, one to Holland and the other to the UKAEA, and a third is working at Langley. Current work at Langley included development of a marine propulsion reactor, but Hawker Siddeley will not now be going ahead with this. Not being connected with any of the large consortia which have grown up in the past year or so, Hawker Siddeley have not shared in large CEGB orders recently.

Shipyard Lighting

AMONG a number of new provisions under the Shipbuilding and Ship-repairing Regulations, 1960, HM Chief Inspector of Factories has now stipulated the types of lamps and torches which may be used in such work. The approval applies to lamps of a type listed and certified as flameproof by the Ministry of Power under groups II and III of BS 229, or lamps and torches of a type listed and certified by HM Chief Inspector of Factories as intrinsically safe.

Unloading at Melbourne of the stator for one of two 120 MW AEI generators for the latest extension to Yallourn power station of the State Electricity Commission of Victoria, Australia

TRAM AND TROLLEY-BUS EQUIPMENT

MINISTRY of Transport requirements for electrical equipment in trams and trolley-buses are set out in a revised Memorandum on Trolley Vehicles, published by HMSO, price 1s. The document provides a detailed guide to technical design from the safety aspect for public service vehicles to be used in the UK. Recent introductions in the memorandum include a code applying when 110 V a.c. supplies are used for fluorescent lighting.

BELLING SALES UP 23%

A 23% increase in sales (just below the 25% target figure), but with a slight fall in profit margins, is part of the achievement of Belling and Co. Ltd. in the past year just announced by Mr C. R. Belling, founder and governing director. In electric fires the company had a "splendid season" and "have also done extraordinarily well" in cooker production, despite being handicapped for space and by building operations. He considers the prospects for 1961-62 are good, providing there are no major troubles, and the target is another 25% increase in production and sales. Although hoping to maintain prices unchanged, he doubts the company's ability to do so, in view of increasing costs.

The 60,000 sq ft extensions at Enfield are now nearly all in use; a new three-storey frontage to the east building has been started, and at Burnley the third 144,000 sq ft building is expected to be in use by October. 1962 sees the fiftieth anniversary of Belling and Co.

PRESTCOLD BANS RETAILER

ANOTHER shot has been fired in the gathering war between discount stores and manufacturers with price maintenance policies. Prestcold have stopped supplying a Leeds retailer because they discovered that he in turn was supplying the new Grandways Discount store, and Grandways were offering 1961 models below list price.

Low Voltage in Leeds

LOW voltage of the public supply in Leeds has caused inconvenience to consumers, the Ministry of Power acknowledged in a written parliamentary answer last week. The Parliamentary Secretary said the cause was an exceptional increase in electricity demand during the past year, complicated by the non-standard pattern of local distribution taken over on vesting day. The YEB had greatly increased its expenditure on reinforcing supplies in Leeds and about half the supplies to consumers had already been converted to standard voltage.

OFFICIAL PUBLICATIONS

Trolley Vehicles. MoT memorandum on the form, construction, dimensions and weights of trolley vehicles and their electrical equipment (revised 1961). HMSO. 1s (see page 570).

Shipbuilding and Ship-repairing Regulations, 1960. Certificate of approval for electric lamps and torches. HMSO. 2d (see this page).

Report on Census of Production for 1958. Part 48: Mechanical Handling Equipment. HMSO. 2s 6d.

BS 1075. Studio spotlight lamps. 5s.

BS 2050. Electrical resistance of conductive and anti-static products made from flexible polymeric material 5s.

BS amendment slips: 161, Tungsten filament general service electric lamps (200 V to 250 V), PD 4032; 903, Methods of testing vulcanised rubber, Part B 19 : 1958 Preparation and examination of water extract, PD 4056; 1433, Copper for electrical purposes. Bar and rod, PD 4047.

ERA Publications:
T/T57, Results of Some Miscellaneous Investigations on Various Combinations of Materials for Use in Meter-type Bearings, G. F. Shotter, 7s 6d; Supp. to Ref. T/T57, Further Investigations on Materials for Use in Meter-type Bearings, G. F. Shotter, 4s 6d.

Post Office Prospects. 1961-62. White Paper. HMSO, 6d.

Mission to S.E. Asia

SE ASIA is the next target for a joint BoT-FBI trade delegation. Under the chairmanship of Sir Edward Thompson, chairman and managing director of John Thompson Ltd., 21 delegates will leave on 11 April for a three-week tour. Similarly to previous drives in other areas, the delegates will split into four separate missions to Malaya-Singapore, Thailand - Burma, Philippines - North Borneo, and Indonesia, then meet in Singapore for a two-day conference. Sir Edward Thomson will lead the Indonesia group.

SEVEN BECOMES EIGHT

Finland Signs Agreement with E.F.T.A.

FINLAND is a member of EFTA in all but name following the signing of an agreement of association in Helsinki last week. From 1 July, Finland will reduce her tariffs towards EFTA countries by 30% on most goods. This is to line up with the 20% cut which EFTA members have already made between themselves, plus the further 10% cut they will make on 1 July; from then on, Finland will keep in step both on tariffs and quantitative restrictions. At Finland's request, a few exceptions have been made to protect her trade with Russia; generators and electric motors weighing not more than 250 kg are the only electrical goods in this category, and on these the 1 July cut will be only 20% and further reductions will be retarded.

The agreement presents UK electrical manufacturers with a unique opportunity to expand business with Finland, for the main supplier has been West Germany and the EFTA tariff advantage will have a cumulative effect following the recent revaluation of the Deutschmark. While Finland manufactures some of her requirements of electrical apparatus and appliances, her imports of these goods from the UK were £2,243,000 last year. This was a sharp rise on imports of £1,384,000 in 1959, when the UK's share of the market was less than a quarter of West Germany's. Finland's main exports to the UK are timber and paper goods.

BOLTON'S NEW MIDLAND OFFICE

THE Birmingham sales office of Thomas Bolton and Sons Ltd. closed at the end of March and the staff have been transferred to 7 Market St, Lichfield, Staffs. That office will now serve the north and south Midland sales areas for the company.

X-rays and Isotopes

REQUIREMENTS for protection of workers against ionising radiations are set out in draft statutory instruments issued by the Ministry of Labour. Known as the Ionising Radiations (Sealed Sources) Regulations, 1961, the present draft comes after two preliminary published drafts, and has been prepared in the light of numerous comments received on those.

The regulations lay down maximum permissible radiation doses which may be received by workers, and they are based on recommendations of the International Committee on Radiological Protection, and supported by the Medical Research Council.

Objections to the proposed regulations have to be made to the Minister of Labour by 9 June next.

BID FOR RETAILER

HENRY WIGFALL and Son Ltd., of Sheffield, are negotiating to acquire the capital of Dobsons (Sheffield) Ltd. The latter concern, like Wignalls, are multiple shop retailers of domestic electrical appliances, radio and TV sets, the bulk of their trade being by hire-purchase or rental terms. A further announcement will be made later.

Hair Dryers and Irons for Approval

HAIR dryers and electric irons, including steam irons, are next on the list for approvals testing by the British Electrical Approvals Board; 28 April has been fixed as the latest date for receipt of applications for testing these appliances if they are to be included in the announcement of approval scheduled for 28 July.

Detailed information and application forms are obtainable from the Director, BEAB, 27 Cockspur St, S.W.1.

Appliances already covered by the scheme are fires, kettles, vacuum cleaners, shavers, toasters, coffee percolators and wash boilers. Announcement of the approval of the first batches of the last four appliances will be made on 1 May.

BEAB's marking of electric blankets waits completion of registration formalities, estimated to take several months. Until registration is completed, BSI will continue operation of its Kite Mark scheme under BS 2612.

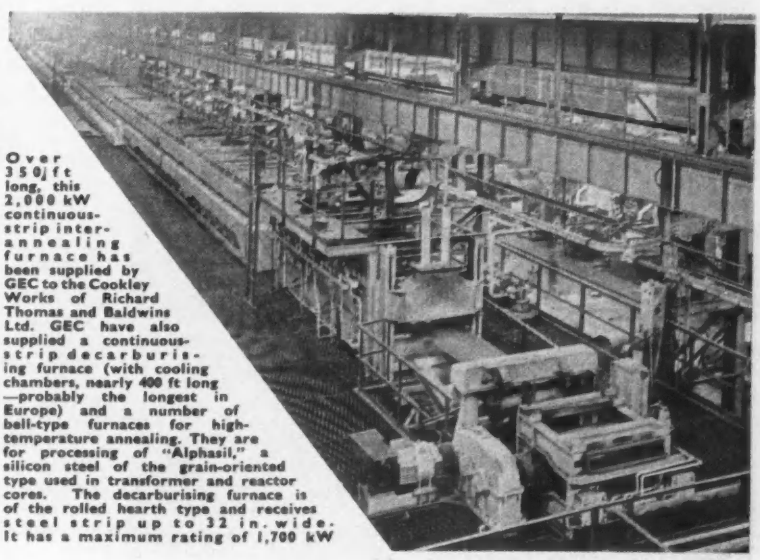
Disappointment after Transformer Case

THE decision of the Restrictive Practices Court is "a severe disappointment" to the Transformer Manufacturers' Association. In a statement issued after the Court's decision ruling against the agreement had been announced, the ten-member association say they attached the utmost importance to the maintenance of the agreements as a necessity for the efficiency and growth of the industry. In consequence they diverted much time and energy to preparation of the case before the Court.

In the opinion of the Association, the decision "can only intensify the problems of the industry in the home market." They feel that still more serious is the fact that loss of the agreement "must impair their ability to develop successfully in the highly competitive export market."

Electric Power Best for Railways

ENGINEERS in America have decided after investigation that electrification is the best motive power for railways, says Mr Ellis Smith, M.P. He asked Minister of Transport, Mr Marples, what study had been made in this country along similar lines and was told that this was primarily a matter for the BTC. There were varying views on each approach; if traffic was light the capital expenditure involved in electrification might "very well not be worth while." The Minister refused to promise an investigation into motive power methods for British Railways; but he said the BTC had taken notice of experiments carried out abroad.



Over 350 ft long, this 2,000 kW continuous-strip inter-annealing furnace has been supplied by GEC to the Cookley Works of Richard Thomas and Baldwins Ltd. GEC have also supplied a continuous-strip decarburising furnace (with cooling chambers, nearly 400 ft long —probably the longest in Europe) and a number of bell-type furnaces for high-temperature annealing. They are for processing of "Alphasil," a silicon steel of the grain-oriented type used in transformer and reactor cores. The decarburising furnace is of the rolled hearth type and receives steel strip up to 32 in. wide. It has a maximum rating of 1,700 kW

Objection to Tariff Rise

CHRISTCHURCH Finance Committee is objecting to the Southern Electricity Board's increase in tariffs under which the final unit rate of the domestic block tariff is raised from 1·125d/unit to 1·375d/unit—an increase of over 22%, they assert. The Committee consider that the increased charges to domestic consumers is out of proportion to that applying to commercial and industrial consumers. The Town Clerk has been asked to inform local authorities in the Board's area of the Council's views.

Electroheat Techniques

PAPERS on electric process heating prepared for the Fourth International Congress on Electroheat held in Italy in 1959 have now been published in two large volumes. All in all there were 185 papers. The volumes are available at 35,000 Italian lira (about £20) from Comitato Elettrotecnico Italiano, Via San Paolo, 10, Milano.

'Fridge Sales Edge Up

HOME demand for refrigerators improved slightly in February when manufacturers' deliveries totalled 54,827, 36% lower than a year earlier against January's comparative decrease of 46·5%. Export deliveries in February were 11,278, up 24·6% on Feb., 1960.

SLOWER RISE IN ELECTRICAL OUTPUT

ELECTRICAL engineering production rose by 5% in 1960, but failed to match the 10% increase by mechanical engineering. This differential was a reversal of the trend of recent years and was due largely to a fall in demand for appliances. According to BoT estimates, combined production in the two industries in January 1961 showed a larger than usual seasonal decrease, and was 9% below the level of the preceding quarter.

A strong influx of home orders for engineering goods as a whole in January resulted in a moderate lengthening of order books at the end of the month. New export orders were down slightly. Compared with a year earlier, orders on hand overall were up fully 15%. Deliveries in January showed the usual seasonal downturn, but were 5% higher than in January, 1960.

The value of deliveries of some major classes of electrical goods, expressed in £ million, is shown in the following table:

Deliveries	Year 1959	Year 1960	1959		1960	
			3rd Qtr	4th Qtr	3rd Qtr	4th Qtr
Rotating electrical machines	128·8	134·2	33·1	37·8	29·3	38·8
Transformers	41·9	43·0	9·9	11·7	10·4	11·5
Switchgear and control gear	108·5	115·8	25·0	29·1	27·7	30·9
Other electrical machinery	16·3	19·0	4·3	4·4	4·4	4·9
Insulated wires and cables	116·8	131·6	26·8	31·4	30·0	35·4
Domestic appliances (except radio and TV)	138·2	131·4	34·5	40·4	30·9	36·8
Electrical equipment for vehicles and aircraft	58·8	63·0	13·3	16·2	15·0	14·9
Lamps	19·3	22·5	4·3	5·7	5·2	6·5

Repeat Order for G.E.C.

GENERAL Electric Co. have received a repeat order from Dorman Long for a 100,000 c.f.m. turbo-blower worth £139,000. The first is already under construction and, when completed, the two units will be placed alongside two existing 90,000 c.f.m. GEC blowers at present in use at the Cleveland steel works. The new blowers will be of the centrifugal type with three impellers of 66 in. dia. running at up to 3,200 r.p.m.

Computers for Sale

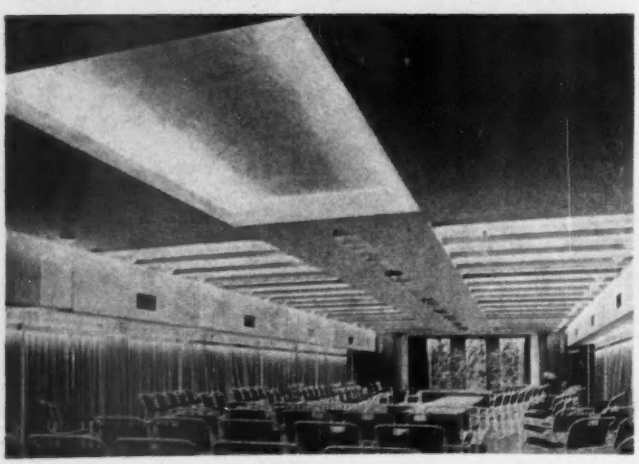
PRESENT and future roles of digital computers in the steel industry will be discussed at three sessions of the annual general meeting of the Iron and Steel Institute, scheduled for 3 May and 4 May. Papers will be presented on computers in research and design, and production, control and information handling; and there will be informal discussions on the use of computers for in-line process control. Speakers in the discussion will include engineers from the Netherlands and the USA. Another technical session at the meeting will be concerned with oxygen in steel making.

The Institute is inviting members of the British conference on Automation and Computation to take part in the meeting, further details of which are obtainable from the Assistant Secretary, Iron and Steel Institute, 4 Grosvenor Gardens, S.W.1.

LIGHTING A FASHION THEATRE

LAVISH use of lighting is a feature of the new building completed for Berketex in Oxford St, London. The fashion theatre, on the first floor, shown below, includes a theatre-type stage with a walkway for models leading down the centre of the main area. Here, the Atlas lighting installation, with fluorescent tubes within a continuous slot in the suspended ceiling, plus 150 W internally silvered incandescent lamps, provides over 100 lumens/sq ft on the walk-away. Illumination for the auditorium, at 80 lumens/sq ft, is provided by lighting beams spanning the walls, fitted with 8 ft fluorescent tubes arranged to give upward and downward light. Thyratron dimming equipment allows complete control. The stage itself has a comprehensive lighting system including three-colour fluorescent background lighting with automatic colour change.

The Oxford St windows of the ground floor shop have been designed for a 200 lumens/sq ft installation using 400 W colour-corrected mercury lamps, plus 50% g.p. incandescent wattage, together with low voltage ceiling and floor-level spots and static coloured fluorescent background lighting.



Seeing the fashions should present no difficulty with the lighting provided in this fashion theatre, and there is dimming equipment to permit the romantic touch

New Spring Courses

A SPECIAL course of six lectures on "Fuel Cells for Power Production" is to be given at the Regent St Polytechnic on Tuesday evenings, commencing 11 April. Authors are Dr A. B. Hart and Mr P. S. K. Eaves. The course will cover the various types of fuel cell, materials and control problems, applications and prospects. Fee for the course is £1 1s.

At the Borough Polytechnic, a short course of evening lectures in "Electrical Installation Design" is to be given on Wednesday evenings, commencing 19 April. Initiated at the request of the Electrical Contractors' Association, the course will cover lighting, heating and motor installations, both small and large. In addition there will be an optional course to conduct design projects (on Friday evenings from 5 May). Fee for each course is £1. Holders of ONC or C and G certificate are preferred, but applications will be considered for all persons with a reasonable technical knowledge.

SUPPLY STATISTICS

OUTLINE figures for electricity supply in England and Wales are assembled in a reference card produced by the Electricity Council. Generation, distribution, retail trade and employment within the supply industry are set out in what is planned to be an annual publication. Copies of "Statistical Digest" may be obtained free on application to the Press and Information Officer, Electricity Council, 1 Charing Cross, S.W.1.

PRECEPTS FOR EUROPEAN TRADE

OF vital importance when dealing with the Common Market countries was salesmanship and tenacity, said Sir William McFadzean when he addressed the Batti Wallah's at their monthly luncheon last Thursday. This, he said, must be backed by two other principles—we must do everything in our power to build up EFTA, not only in the interests of our trade but also to increase our bargaining power, and we must work with all patience and determination for a united Europe. Division in Europe was a tragedy, he said, but at the same time the European situation must be kept in perspective with world events. The question whether we could offer greater social and economic attractions to the underdeveloped countries than the Soviet-Sino bloc was of vital miportance. A vote of thanks was proposed by Sir Harold Bishop. The next luncheon will be held at the Connaught Rooms on 27 April.

Illumination Meeting

TWO papers will be delivered at a week-end meeting which the Illuminating Engineering Society will hold at Peebles from 5 May to 7 May. One is on the new IES code, by Mr W. Robinson, of EDA, and the other on lighting practice in the US by Mr C. L. Crouch, technical director of the IES of America, who is travelling especially from New York. The programme is largely social.

Sayings OF THE WEEK

"In a way the Solent is the equivalent of Lake Windermere, and nobody would think of putting down a power station on Windermere." . . . MR JOHN BETJEMAN, opposing the Calshot power station scheme.

"Surely if we consider the fundamental issues involved, the silliest thing we can do is to import something which we can perfectly well make for ourselves." . . . MR N. F. T. SANDERS, managing director, Kelvinator Ltd., writing to the *Financial Times* on the subject of import restrictions.

"The amateur handyman can be more of a menace than the amateur handywoman, because he has far more confidence." . . . MISS MARY GEORGE, director, Electrical Association for Women, speaking at Bristol branch dinner.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, April 4

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	225½	+½
" (3 months)	227½	+½
LEAD, refined pig, 99·97% purity (cash)	65½	−¾
" (3 months)	67½	−¾
TIN, refined, min. 99·75% purity (settlement)	824½	+2½
(3 months)	827	+4½
ALUMINIUM, ingots 99·99·5%	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	198½	−3½
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	84½	+1½
" (3 months)	84	+1½
RUBBER, per lb.		
No. 1, RSS, spot	25d	−⅛d
c.i.f. basis, ports, June	24⅛d	−⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69	—
AMERICAN PRICES:		
Copper, electrolytic (per lb)	29c	—
Lead, (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

More Sandwich Courses Suggested

TWO sandwich courses a year at universities and colleges for trainees in industry are advocated by the Electrical and Electronic Manufacturers Joint Education Board. Formed a year ago and administered from BEAMA headquarters, the Board made this suggestion to the Ministry of Education and it is now under consideration by a sub-committee of the National Advisory Council.

The Board has also been seeking a means of filling the gap in facilities for training draughtsmen for such specialist tasks as laying out electronic circuitry and printed wiring boards. A full-time pilot course of two or three weeks duration will be held at Crawley Technical College if sufficient support is obtained, representatives of the seven constituent trade associations were told at the Board's annual meeting recently. A proposal to form a standing conference of training officers to provide a link with the Board was also put forward and a meeting to set up the conference will be held in the autumn if reaction is favourable.

Travellers' Schools Appeal

MR A. T. HAYWOOD, joint managing director of Electrical Components (Holdings) Ltd., Birmingham, is launching an appeal for the Royal Commercial Travellers' Schools at Pinner. As President of Appeal for the coming year he hopes to raise over £50,000 in donations for the schools, which provide free education for sales representatives' children who have lost one or both parents and below-cost education for other representatives' children. A grand fête is being held at the school on 17 June to raise funds.

N.U.T. CAREER GUIDE

ELECTRICITY supply has an article to itself in the 1961 issue of annual careers guide for school leavers, prepared by the National Union of Teachers. It is one of several articles under the linking heading "What's it Like." The guide, of which 21,000 free copies have been distributed to secondary schools and youth employment officers, is available, price 3s 6d, from the Publicity Department, NUT, Hamilton Hse, Mabledone Pl, London, W.C.1.

News in Brief

A conference on the problem of communications between science and industry, organised by the DSIR, is to be held at Brangwyn Hall, Swansea, on 18 April.

A Crompton oil circuit-breaker installed at Richard Garrett Engineering Wks, Leiston, in 1916 has just been removed from service and has been placed in the Crompton Historic Collection at Chelmsford. A similar breaker has also been presented to the Science Museum, South Kensington.

The Industrial Equipment and Services Exhibition is to be held at Bingley Hall, Birmingham, from 29 May to 3 June.

An explosion in a generator at the Peel power station of the Isle of Man Electricity Board on 23 March cut off supplies to a large part of the island for several hours.

Cutting refrigerator production because of continued depression in the market, R. and A. Main Ltd. have given notice to 130 workers at its Edmonton works.

A choral and orchestral concert was given last week by the LEB Lessa music society. The performance was worthy of a larger audience.

Pye's large factory near Milan is now in production and will be operated by a company to be called Pye Electronic SpA, with Mr L. W. Jones as managing director.

Manufacture of American designed magnetic and electrostatic guns for television cathode ray tubes has begun at Bray, County Wicklow, by Griffiths Electronic Guns Ltd., newest member of the Sam Carpenter Group.

Manweb provided over 6,000 million units to nearly 947,000 consumers in the year just ended. Demand was a record and compares with 5,556 million units to 926,000 consumers in 1959-60.

Company Activities

OF the various fauna which inhabit the City the happiest today is the "stag." Those two other fine animals, the "bull" and the "bear" are lying low, each in fear of the other. It is an almost natural result of an uncertain market with little to stimulate interest and business falling to a modest level. In the circumstances, attention has switched swiftly to new issues, and what a fine crop there was to harvest here. In one day, dealings began in four new shares and all established handsome premiums; but it was noteworthy that in all these cases, prices closed well below the best levels, indicating that quite a number of folk had been content to take a quick profit and get out. Dealers have been wondering whether the vast volume of funds used for application purposes will now be reinvested in some other part of the market or whether it was money which normally remains liquid and which was tempted out of its shell solely by the favourable nature of the opportunity. Probably the money will go back to the banks from which it came, at least for the time being.

Buying of heavy electrical shares on above-average yields has now dried up and the remainder given by the full report of AEI that profit margins in this section are still painfully thin, pulled the shares back 1s 6d. AEI also has a financing problem which is made no easier to solve by the low rates of profitability now ruling. Takeover talk which had previously stimulated the shares of Bulpitt's also evaporated, leaving the price 2s lower. On the other hand, Chloride Electrical Storage moved up 3s in front of the results. There was indeed a small increase in the payout, but net profits were lower and, taken as a whole, the results must have come as a disappointment to the optimists. There was nothing very encouraging about the rest of the company news either. Cable makers, Aberdare Holdings, reported a slight drop in profits, although the rate of dividend was held at 17½%; but the big shock was delivered by Bylock Electric. Investors are left to assume that even the directors have been taken by surprise by the turn of events which has resulted in a trading loss, for last March, only five months before the end of the financial year a dividend of 33⅓% was forecast—now there is to be no dividend at all.

An unpleasant surprise of a slightly different kind overtook transformer manufacturers: the Restrictive Practices Court ruled that their association was against the public interest. Returns on capital employed in the industry are not high by any stretch of the imagination and, if earnings get any lower, the raising of fresh equity capital may become a problem.—*From our City Correspondent.*

Aberdare Holdings

Net profit fell £35,788 to £331,544 in the year to 31 Oct., but dividend is held at 17½% by a final payment of 10%. Latest result is after £296,975 tax (previously £294,261).

Associated Electrical Industries

Severe international competition in heavy electrical equipment and pressure on appliances at home is reflected in the accounts for 1960. Profit margins suffered with the result that trading profit fell from £9,355,060 to £8,491,853 despite a 3·4% rise in turnover to £215 million. After tax of £3,769,414, net profit was slightly lower at £4,722,439 and this barely covers dividend commitments, including a steady 15% on ordinary shares,

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	12,957,272	4,373,778	22·1	15	85/6	57/-
1957	13,286,246	4,333,139	21·7	15	73/-	47/-
1958	15,971,205	4,502,396	19·8	15	59/-	46/6
1959	9,355,060	4,746,987	16·5	15	69/-	53/7
1960	8,491,853	4,722,439	16·7	15	67/-	38/6

which total £5,104,912. However, there is no lack of orders, with £181 million on the books at the end of December compared with £173 million last year.

Bakelite Ltd.

Sales in 1960 were a record, though recession in motors and consumer durables reduced turnover in the second half and this is still having an effect. Highly competitive conditions still apply to PVC but the company is maintaining its position. The growing use of printed circuits has resulted in demands for copper clad laminates and the range has been widened. Trading profit rose from £1,250,554 to a record £1,350,808 and dividend was held at 17½%.

British Electric Resistance Co.

Interim dividend is maintained at 5% on capital increased by scrip and rights issues. Despite "extremely keen" competition, turnover rose by 11·5% for the half year to 31 July, compared with the corresponding period of 1959, and the rate of net profit was maintained.

Bylock Electric Ltd.

A £23,953 loss and no dividend is a shock for shareholders, even though they must have made some allowance for the credit squeeze. The loss, incurred in the 12 months to 31 July, 1960, contrasts sadly with the £146,035 pre-tax profit earned in the preceding year. At the time of a one-for-five cash issue last March, directors forecast a repetition of the 33⅓% dividend paid for the past six years; while March was only four months from the end of the financial year, directors could not have foreseen that h.p. restrictions were just around the corner. After a tax credit of £16,491, net loss for the year is £7,462 against an adjusted net profit of £80,133 for 1958-59.

Chloride Electrical Storage Co.

Dividend is raised by 2½% to 20%, with a final 15%, despite last year's recession in the motor trade. Net profit of £1,348,535 covers the higher payout, and there is also an additional profit of £212,332 relating to previous years and £835,744 brought in. In view of the more difficult trading conditions, the 1960 profit represents a good showing against the record £1,473,287 netted in 1959. Latest result is after £1,043,216 UK tax and £382,129 other tax.

Ether Langham Thompson

A slackening of orders had taken place since the year ended on 30 Sept., but the current trading position and order book were good, the chairman and managing director, Mr F. B. Duncan, said at the annual meeting. Competition continued to be intense and rising costs had cut profit margins, but expansion of activities and new products being introduced should increase turnover. Ether Ltd. and Electro Methods Ltd. had contributed £152,981 to the £278,337 pre-tax profit earned by the merged Ether and Langham Thompson groups.

Hoover Ltd.

UK sales were down 18% for the first 11 weeks of the current year, but exports rose by 13%, shareholders were told at the annual meeting. Cost increases, due to the restriction of demand and higher wages, have had "considerable effect" on margins. Little alleviation could be expected until the h.p. deposit was reduced.

Sangamo Weston

A one-for-three scrip issue is announced and dividend is up from 11% to 13⅓%. Trading profits jumped from £422,451 to £522,120, the best since 1955 and almost a record. Net profit is up from £164,608 to £202,875, after tax of £198,395 (*£146,214*).

Sterling Electric Holdings

Payment of interest on funding certificates and dividend on the cumulative preference shares, due this month, are being deferred.

Watford Electric

A "Rights" issue is being considered by directors to finance the proposed acquisition of a small factory and adjoining ground outside the Watford area. Orders on hand are at a record level, and the chairman forecasts a better year. By way of explaining last year's disappointing results, when trading profit dropped from £140,727 to £70,130, the chairman says that production was severely disrupted in the early part of the year by the non-availability of technical details on a large contract.

Dividend Declared

Perak River Hydro-Electric. Interim 4% (*same*).

OVERSEAS NEWS

from our correspondents abroad

CANADA

Little Long Rapids Contract

Following their earlier success this year in securing a contract for three generators for the Grand Rapids hydro-electric scheme, the English Electric Division of John Inglis have now been awarded the contract for two 84,000 h.p. turbines by Ontario Hydro. These units will be installed at the Little Long Rapids hydro station on the Mattagami River after their completion in late 1962. Design work and model tests will be undertaken by English Electric at their Netherton and Rugby works. The turbines will operate under a 90 ft head at a speed of 94·7 r.p.m.

Ontario Hydro Hit by Natural Gas

Natural gas is cornering the energy market in Ontario to the extent that increased hydro rates are inevitable, said the chairman recently. In many municipalities, he said, energy consumption per consumer was not matching rising cost of construction and operation. To avoid raising prices, Ontario Hydro will this year use reserves valued at $4 million to supply power at less than cost. The Commission expects to borrow between $75 million and $100 million this year, although under present recession conditions they are trying to limit their borrowing where possible.

Expenditure in NB During 1961

Public and private expenditure on industrial projects is estimated this year to be $100 million, considerably less than last year's total of $175 million. The New Brunswick Power Commission will spend a further $2 million on the St. John thermal station, scheduled for commissioning in August. Other allotments amount to $10 million, or $2½ million less than last year. The estimates include $2·3 million for expansion at the Beechwood Hydro plant, $4 million for terminal stations and transmission lines, $2·2 million for distribution and the remainder for substations and communications.

Local Buying Campaign by BCE

A campaign to urge local manufacturers to provide the goods and services needed by BCE has been launched. Last year the BCE service area received 63% of the $27 million purchases by the company. More than 90% of the company's 1960 purchases were made from Canadian firms. Local businessmen will be invited to BCE stores to learn the company's needs. The programme is being intensified during the slowdown in the economy in the expectation that it will stimulate local industry.

MALTA

Power Station Tenders Invited

A combined power station and water distillery is to be constructed at Marsa and tenders are invited for two contracts. The first contract covers constructional steel work, while the second is for civil engineering work and also for the two boilers, for the two 12·5 MW turbo-alternators and the distiller unit. Applications for an explanatory memorandum should be addressed to Freeman, Fox and Partners, 25 Victoria St, S.W.1, not later than 7 April.

S. AFRICA

Komarti Contract for AEI

A £2 million order for turbo-generators, condensers and feed-heating equipment has been awarded to AEI by the Electricity Supply Commission of South Africa. The two 125 MW turbo-generators will be installed in the Transvaal's Komarti power station. The contract, which was won in the face of stiff European competition—previous machines for this station were supplied by a West German firm—is due for completion in 1964.

Reactor Construction Contract

The construction contract for the research reactor to be built at Pelindaba, near Pretoria, has been awarded to a local company. The reactor, of a modified Oak Ridge type, is being designed in the US and about 70% of the manufacturing work on reactor and building construction will be undertaken by South African companies. This was stated recently by the Director of the South African Atomic Energy Board, Dr Roux. He added that the reactor should be in commission by the end of 1963.

PAKISTAN

Village Electrification

To finance the plans for electrifying 5,000 villages in West Pakistan, WAPDA has placed a firm demand with the US Development Loan Fund. Under the scheme about 1,665 villages in the frontier districts, 3,246 villages in northern Punjab and about 100 in central and southern areas will be electrified. Nearly 11,000 miles of 11 kV distribution lines will be needed.

INDIA

Transformer Tenders

Tenders are invited for 11 kV/416 V transformers rated from 15 kVA to 100 kVA. Specifications and tender forms may be obtained from N. Tata Rao, secretary, Madhya Pradesh EB, Jabalpur, for a submission of Rs50. Tenders must be received by the EB before 29 April.

AUSTRALIA

Tariff Cut in Western Australia

Consumers will pay up to 8% less for their electricity and gas as a result of new coal contracts undertaken by the Southern Electricity Commission. Rapid rise in demand for electricity, improved transmission and other factors made it possible for the Commission to reduce tariffs in certain instances to less than they were ten years ago, said the acting Premier, Mr Watts, recently. Generating stations were now being sited nearer the coalfields, notably the Bunbury station, while the future trend will be to site stations actually on the coalfields. Rural consumers now numbered some 2,500 and these had been helped recently by the grants scheme enabling them to get power beyond the economic limits of the SEC network. Under this scheme, the farmer paid annual charges for sections of line exceeding 40 chains in length.

Turbo-generator Tenders

For the last stage of the Brisbane city power house extension, eight tenders have been received covering the turbo-generator plant. They range in value from £875,360 to £1,045,328. The generator will probably not be installed before 1964.

Campaign for Off-peak Heating

A £20,000 campaign to publicise the value of off-peak heating for the home has been launched by the Hydro-Electric Commission. At a conference in Hobart recently, the Commissioner said the aim of the campaign was to increase off-peak use of electricity, already encouraged by tariffs. Between 9 p.m. and 7 a.m. the tariff was 0·65d, compared with 1·7d during other hours. Manufacturers from Tasmania, Victoria and NSW heard the Commissioner say that Hobart used twice as much electricity per head as other Australian cities and that nearly 70% of Tasmanian homes already had hot-water services.

Safety Rules Revised

Earthing wires in Australia's new homes are required to be larger to comply with the latest revision of the wiring rules. These rules, published by the Standards Association of Australia, specify the minimum legal requirements for the wiring of homes, offices and factories. The revised edition is the first for 11 years and applies in all States, except Victoria which issues its own regulations.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

6 April—Cardiff C.C. Electrical installation in one-bedroom flats.—See 23 March issue.

6 April—N. Ireland H.A. (2) Electrical work in two patients' villas, Muckamore Hse.—See 30 March issue.

7 April—Batley B.C. Supply: columns/lanterns, gear and sodium lamps.—See 30 March issue.

7 April—Edinburgh T.C. Supply and installation of two 100 ft/min eight person/perambulator lifts plus one with stretcher extension in seven-storey block, Leith Fort housing development. Applications to City Architect, City Chmbrs, by above date.

7 April—Southport C.B.C. (1) Electrical equipment for home for the aged kitchen, at Ainsdale.—See 23 March issue.

8 April—Bournemouth C.B.C. 260 Group "A" and 2,800 Group "B" lighting units including 1,200 special brackets and spigot boxes.—See 30 March issue.

10 April—Barrow-in-Furness C.B.C. Supply and erection of two 8,000 g.p.m. main pumps and one sump pump of 800 g.p.m., together with motors and gear for Sandgate Pumping Station.—See 23 March issue.

10 April—Basildon U.D.C. 99 Class "B" tungsten lamps on concrete columns and supply of 225 pole bracket lamps.—See 30 March issue.

10 April—E.B. for N. Ireland. Two 15 MVA 110/33 or 11 kV power transformers. Applications to consulting engineers, Kennedy and Donkin, 12 Caxton St, S.W.1, by above date. Deposit £5 5s made payable to E.B. for N. Ireland.

10 April—Dartford B.C. Rewiring in modernisation, 71 houses, Lowfield St estate.—See 16 March issue.

10 April—Dewsbury C.B.C. Supply of office furniture and electrical equipment for mental health office. Medical Officer of Health, Public Health Dept., Municipal Bldgs, Halifax Rd.

10 April—Llanelly B.C. Supply of lanterns, lamps, columns, brackets, time switches and gear for 250 60 W sodium units. Borough Engineer and Surveyor, Town Hall.

10 April—Manchester C.C. Electrical installation in aged persons' home, Goodier St, Harpurhey.—See 23 March issue.

10 April—Manchester C.C. Electrical installation in Whitebrook School for the Deaf, Fallowfield.—See 30 March issue.

10 April—N. Ireland H.A. (3) Electrical work in two patients' villa, Muckamore Abbey.—See 30 March issue.

10 April—Rowley Regis B.C. Supply: electrician's requisites and batteries.—See 30 March issue.

10 April—Weston-super-Mare B.C. Supply of 34 twin lamp fluorescent fittings for abattoir. Borough Engineer, Town Hall. Deposit £2.

11 April—Bradford C.C. Electrical installations in 281 dwellings Allerton Hsg Site (Scheme 54). City Engineer and Surveyor, Town Hall. Deposit £2 2s made payable to Corpn.

11 April—Dunbartonshire C.C. Street lighting maintenance.—See 30 March issue.

11 April—East Riding C.C. Electrical services installation in Howden County Secondary School.—See 30 March issue.

12 April—Ipswich C.B.C. Electrical installation in proposed Chantry estate new secondary modern school. Applications to architects: Johns, Slater and Haward, 32 Foundation St, by above date. Deposit £2 2s, made payable to Corporation.

12 April—Shipley U.D.C. Electrical installation renewal in Manor La Baths.—See 30 March issue.

12 April—Stokesley R.D.C. 250 g.p.m. sewage pumping plant (Contract 2) and (Contract 3) electrically operated air compressors and ejector plant.—See 23 March issue.

12 April—Tyne Improvement Commission. Supply of rail-mounted, 30 ft jib, ten-ton crane.—See 23 March issue.

12 April—Ulster Transport Authority. Supply: lamps; cables and flexibles; torches, cycle lamps and batteries.—See 30 March issue.

14 April—Belfast C.C. Electrical installation Falls Rd branch library. Electricity Dept., East Bridge St. Deposit £2 2s.

14 April—Cardiff C.C. Installation of seven-person passenger lift at Fairwater Hse, Fairwater Rd. City Surveyor, City Hall. Deposit £2 2s, made payable to Corporation.

14 April—Letchworth U.D.C. Removal/resiting and conversion of 93 steel columns and erection of 41 Group "A"/104 Group "B" concrete columns and 16 steel Group "B" columns, together with the installation of lanterns/gear.—See 30 March issue.

14 April—Morley B.C. 27 140 W sodium units on 25 ft concrete columns.—Advertised 16 March issue.

14 April—Pocklington R.D.C. Duplicate 85 g.p.m. sewage pumps and an 80 g.p.m. sludge pump, together with motors.—See 30 March issue.

14 April—Redcar B.C. Erection only of street lighting for 1961-62 programme. Borough Engineer, Redley Hse, Coatham Rd.

15 April—Chapel-en-le-Frith R.D.C. Electrical installation in eight houses.—See 30 March issue.

15 April—Coleraine R.D.C. Electrical installations in 22 dwellings.—See 30 March issue.

17 April—Flintshire C.C. Provision and erection of: distribution; pillar; eight 30 ft columns; 200 W sodium lanterns; four fluorescent units for advance direction signs; and wiring, including 12 "Keep Left" bollards.—Advertised 23 March issue.

17 April—Newcastle upon Tyne C.C. One 40-ton, two ten-ton and two six-ton travelling cranes.—See 30 March issue.

17 April—Port Talbot B.C. 36 35 ft steel columns with double outreach; ten 35 ft columns with single outreach; 45 200 W sodium lanterns; 18 "Keep Left" bollards; 2,300 yd cable, traffic signs, etc., for Talbot By-Pass lighting.—See 23 March issue.

17 April—West Riding C.C. (a) Provision of motorway signs and fixing/wiring of sign lighting; (b) provision of 80 W fluorescent floodlighting lanterns, also 8 W and twin 6 W lighting.—See 30 March issue.

18 April—Bury C.B.C. (a) Supply of 61 30 ft steel or concrete columns and 200 W sodium lanterns, lamps, gear and time switches; (b) erection; (c) removal of 120 existing traction type standard o/h lines, etc. Street Lighting Superintendent, Hacking St.—Advertised in this issue.

18 April—Maidstone B.C. Supply and erection of: 83 25 ft steel columns; 103 Group "A" flourescent lanterns; 49 20 ft steel columns; 49 intermediate fluorescent lanterns; 165 15 ft steel columns and Group "B" fluorescent lanterns. Borough Engineer, Palace Ave.

18 April—Sunderland C.B.C. Electrical installations in 305 dwellings, Town End Farm estate.—Advertised 30 March issue.

18 April—West Riding C.C. Electrical installation in Gomersal C.E. school.—See 23 March issue.

19 April—Athy U.D.C. Duplicate 14,000 g.p.h. water pumps.—See 16 March issue.

20 April—Wallasey C.B.C. Electrical installations in 46 maisonnettes, Mersey St area.—Advertised 30 March issue.

21 April—Bedlingtonshire U.D.C. Supply: electrical goods, cookers and boilers.—See 16 March issue.

21 April—Larne B.C. Electrical installation in Municipal Offices.—See 30 March issue.

24 April—Blackpool C.B.C. Supply of: 120 Group "B" concrete columns, fluorescent lanterns and brackets; 150 synchronous solar dial time switches; 30 Group "A" concrete columns/brackets and fluorescent lanterns. Director of Lighting and Electrical Services, Rigby Rd East.—Advertised in this issue.

24 April—King's Lynn B.C. Centrifugal pumps and ancillary equipment for Dock Outfall Station. Borough Engineer: H. G. Ridler, 17 Queen St. Deposit £2 2s.

24 April—Rhondda B.C. Group "A" sodium lighting on pre-stressed spun concrete and steel columns along 10¼ miles of classified roads.—Advertised 30 March issue.

29 April—Otley U.D.C. Supply and erection of 50 Group "A" tubular steel columns/brackets, lanterns, lamps, gear and wiring of 250 W and 400 W colour-corrected mercury lighting along 1·069 mile Pool Rd,

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 114 queries answered this week

"Everest" appliances—address for? T.B.—Elgee Refrigeration Ltd., 180 Brompton Rd, S.W.3.

"Vesta" lamps—suppliers of? E.C.—Universal Distributing Co. Ltd., 66 Gt. Eastern St, E.C.2.

"Rotel" food mixers—address for? E.D.—Rotel (G.B.) Ltd., 55 Park La, W.1.

"S.L.R." irons—makers of? S.E.B.—S.L.R. Electric Ltd., Cranbourne Industrial Estate, Cranbourne Rd, Potters Bar, Middx.

Razor socket outlets with companion isolating transformer—makers of? J. and P.—Chilton Electric Products Ltd., Hungerford, Berks; Kentish Electrical Co. Ltd., 112 Albany St, N.W.1.

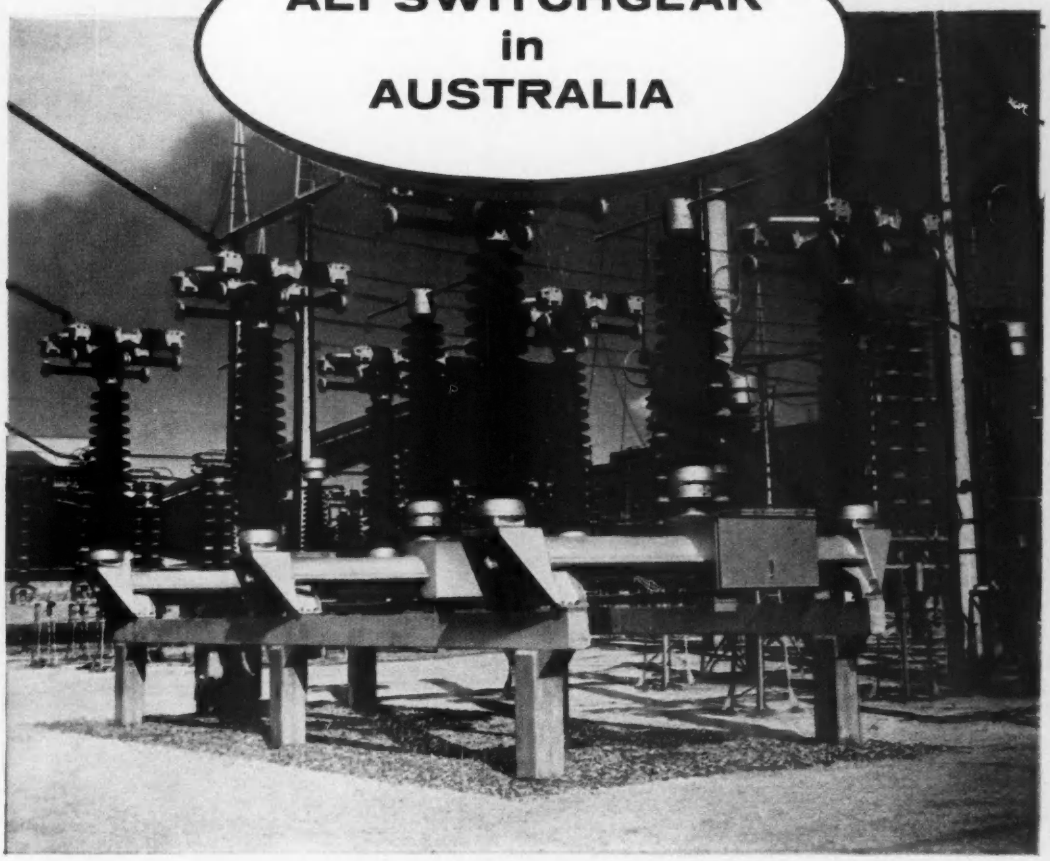
"Nuclear Century Convector" convector heaters—makers of? L.C.—Castle Castings Ltd., Brooks Wks, Waterloo Rd, Clitheroe, Lancs.

"Soli-vut" health lamps—agents for? R.G.—Sierex Ltd., 241 Tottenham Court Rd, W.1.

"Cyclo" farm grain dryer—makers of? F.W.—British Tufting Machinery Ltd., Blackburn, Lancs.

"Ardee" underfloor heating system for wood block flooring—makers of? J.L.—David Robinson (Floors) Ltd., Herbert St, Cardiff.

AEI SWITCHGEAR in AUSTRALIA



Type GA 10 X 8 air-blast switchgear, at the Sir Thomas Playford Power Station, Port Augusta, S. Australia. Photograph by courtesy of the Electricity Trust, S. Australia.

The first switchgear with a rating of 330kV, 10,000MVA commissioned in Australia was constructed by AEI for the Snowy Mountains Hydro-Electric Authority and the Electricity Commission, New South Wales.
In addition, 275kV switchgear of the type illustrated, is now in service at the Magill Substation, Adelaide and the Sir Thomas Playford Power Station, Port Augusta, South Australia.
These installations make a further and impressive contribution by AEI to the development of Australian power resources.

For further details, write to AEI Switchgear Division, Trafford Park, Manchester 17, or to your local AEI Office.

AEI

Associated Electrical Industries Ltd.
Switchgear Division

TRAFFORD PARK, MANCHESTER · HIGHER OPENSHAW, MANCHESTER · WILLESDEN, LONDON
F/A 024

An exciting new Pole Top Unit is now added to the extensive range of Simplex contemporary Screwglass fittings.

The Simplex Pole Top Screwglass is weatherproof and therefore suitable for all industrial and commercial applications.

It will take Tungsten or Mercury Fluorescent Lamps. The reflector is made from top quality anodised aluminium, stove enamelled red, yellow, turquoise, black or white as required. The moulded screwneck glass is internally etched to avoid glare and is protected by a strong galvanised wire guard.

The comprehensive range of Screwglass Fittings allow easy installation in any situation, top or side entry, or wall mounting. Interchangeable Nylon reflectors in either red, yellow, blue, white or black can be added to enhance appearance.

Galvanised steel wire guard is also available for all sizes from 40 to 200W.

For full details please write to :
SIMPLEX ELECTRIC CO. LTD., LIGHTING DEPT.,
CREDA WORKS, BLYTHE BRIDGE,
STOKE-ON- TRENT, STAFFS.
Branches throughout Britain and agents throughout the world

A659. Engineer and Surveyor, North Parade. Deposit £1 1s.—Advertised in this issue.

29 April—Staffordshire C.C. Supply of (a) demonstration equipment for electrical laboratory; (b) chemical laboratory major equipment; and (c) X-ray apparatus for nucleonic block.—Advertised 23 March issue.

29 April—Staffordshire C.C. Supply: batteries and battery chargers.—Advertised 30 March issue.

1 May—Ipswich C.B.C. Electrical installation in St. Mathew's Baths.—Advertised 30 March issue.

1 May—Worksop R.D.C. Contract 2. Supply and erection of duplicate 150 g.p.m. sewage pumps complete with motors, starters and accessories. Details from consulting engineers, J. H. Haiste and Ptnrs., Belmont Hse, 20 Wood La, Headingley, Leeds 6. Deposit £3 3s made payable to R.D.C.

2 May—Newry No. 2 R.D.C. Duplicate 25 g.p.m. at 335 ft head pumps for Tullymacreeve Booster Station.—See 30 March issue.

4 May—Belfast C.C. (a) Electrical installation in Tower St Institute for Further Education. City Architects' Dept., 40 Academy St.

5 May—Tyrone C.C. Electrical and mechanical installations in new county H.Q. Details from consulting engineers: McCandless and Barton, 6 Murray St, Belfast 1. Deposit £3 3s.

9 May—Athlone U.D.C. Supply and installation of duplicate 52,000 g.p.h. at 40 ft head water pumps complete with electrical equipment. Details from consulting engineers, N. O'Dwyer Son and Ptnrs., 6 Burlington Rd, Dublin. Deposit £10 10s.

15 May—Newcastle upon Tyne C.C. Electrical installation, baths and laundry, Montagu estate.—See 16 March issue.

No date stated—Bristol C.C. Electrical work in boiler and heating installation, College of Commerce.—See 23 March issue.

12 June—E.B. for N. Ireland. Two 25,000 g.p.m. circulating water pumps and non-return valves for Coolkeeragh. Details from consulting engineers, Kennedy and Donkin, 64 Royal Exchange, Manchester 2. Deposit £5 5s made payable to E.B. for N. Ireland.

No date stated—Sheffield C.C. Waterworks. Supply and installation of 11/3·3 kV and 3·3 kV/415 V transformers, 3·3 kV air break switches, 3·3 kV contactor starters, etc., for Yorks Derwent Scheme.—Advertised 30 March issue.

TRADE NOTES

Changes of Address. Asbury, Brodie and Co. Ltd. have moved to Target Wks, Hancock Rd, Birmingham 8. Telephone: East 3761.

Wm. Don Ltd. have this week moved to Kerry Hill Wks, Horsforth, Leeds. Telephone: Horsforth 4286.

New Telephone No. The telephone number of Kabi (Electrical and Plastics) Ltd. has been changed to Potters Bar 534444.

Trucks in U.S. Lansing Bagnall Ltd. have completed preliminary plans for the manufacture and distribution of their materials handling trucks in the U.S. by Towmotor Corporation of Cleveland, Ohio. Under the arrangement, the latter's larger trucks will be available in the U.K. through Lansing Bagnall.

E.W.F. Wholesale Electrics (Jersey), of 19 James St, St. Helier, Jersey, C.I., has been elected a member of the Electrical Wholesalers' Federation.

Export Div. The Cedco group of companies have formed Cedco (Overseas) Ltd. to take over the Export Division of Claremont Electrical Distributing Co. Ltd.

Expansion. Geo. Salter and Co. Ltd. has obtained approval to a £100,000 extension to its West Bromwich factory.

New Showrooms. H. C. Troldahl Ltd., Frigidaire distributors for the Northern Counties, have opened new showrooms at 40 Scotswood Rd, Newcastle upon Tyne 4.

Iran's Imports. Among the list of goods which may be imported into Iran either on Letter of Credit or a Bill or Sight Draft terms (against 25% deposit on Letters of Credit) are insulated cable and wire, apparatus for regulating, switching, protecting and distributing electric current, telegraph and telephone apparatus, electric generators, motors, convertors, transformers, steam boilers and electric locomotives.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

AEG Turna in design. 808,936. Class 7. Washing and clothes drying machines. Allgemeine Elektricitats-Gesellschaft, 150 Hohenzollerndamm, Berlin-Grunewald, Germany.

Atlas. 813,159. Class 10. Lamps and lighting apparatus for medical purposes, etc. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

Berco Green Spot. B797,395. Class 9. Fixed and variable vitreous enamelled wire-wound resistances. British Electric Resistance Co. Ltd., Queensway, Enfield, Middx.

Cardiator. 794,199. Class 9. Cables, connections, contact devices, etc. W. F. Wheeler, "Toogoolawah," Newdigate, Surrey.

Emicord. 811,867. Class 9. Flexible conductors. Electric and Musical Industries Ltd., Blyth Rd, Hayes, Middx.

Permark. 812,433. Class 17. Identification sleeves, etc. Permark Service Ltd., Permark Hse, Ewhurst Rd, Cranleigh, Surrey.

Polyblok. 813,013. Class 9. Mounting boxes for fittings. Ashley Accessories Ltd., Morecambe Rd, Ulverston, Lancs.

"Sartrac." 809,663. Class 9. Apparatus for use in the automatic recording and booking of leading accommodation, etc. Standard Telephones and Cables Ltd., Connaught Hse, 63 Aldwych, W.C.2.

Silver Knight in design. 794,281. Class 11. Installations for lighting, heating, etc. Silver Knight Industries (Manchester) Ltd., Reymith Wks, Barkworth St, Manchester 10.

Summit. 793,616. Class 11. Cooking stoves, boiler plates, urns, etc. Edmundsons Electrical Wholesalers Ltd., 240-250 Ferndale Rd, S.W.9.

H

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

14 April—America. 420 ft 15 kV three-conductor cable and pothead. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/10463/61).*

14 April—America. Three 138 kV potential transformers. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Contract-Pur. Unit, Bldg 53, Denver Federal Center. B.o.T. (ESB/10464/61).*

15 April—Egypt. Air-conditioning equipment for High Dam site buildings. Sadd-el-Aali Dept., 56 Giza St, Cairo. B.o.T. (ESB/10092/61).*

17 April—S. Africa. 13 items, l.v. and e.h.v. p.i. cable. Town Clerk, Room 108, Municipal Offices, Johannesburg. B.o.T. (ESB/10079/61).*

20 April—America. One 230 kV, 1,200 A c.b. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/10483/61).*

23 April—Iraq. Fluorescent fittings. Purchase and Tender Office, Iraqi Ports Admin., Basrah. B.o.T. (ESB/10473/61).*

24 April—Australia. Capacitor banks (three items), reactors and spares. S.E.C. of Victoria, 22-32 William St, Melbourne. B.o.T. (ESB/10059/61).*

24 April—Canada. Cable and accessories to provide two 120 kV circuits between Dorchester and Fleury substations, Montreal. Chief Engineer, Eng. Design Division, Hydro-Quebec, 107 Craig St West, Montreal. B.o.T. (ESB/10063/61).*

27 April—America. Two 161 kV, 1,200 A o.c.b's for Bull Shoals. U.S. Corps of Engineers, Little Rock District. B.o.T. (ESB/10008/61).*

27 April—Pakistan. Three slip-ring motors. Chief Controller of Purchase, P.W. Railway, Empress Rd, Lahore. B.o.T. (ESB/10828/61).*

28 April—Australia. 11 kV, 3-ph. 300 A ring main switchgear. Town Clerk, City Hall, Brisbane. B.o.T. (ESB/9631/61).*

2 May—America. Two 47,368 kVA alternators for Bull Shoals. U.S. Corps of Engineers, Little Rock District. B.o.T. (ESB/10090/61).*

4 May—America. 480 V switchgear and distribution centres, Greers Ferry. U.S. Corps of Engineers, Little Rock District. B.o.T. (ESB/10476/61).*

12 May—Australia. Inverse time over-current relays (two items) and 110 V d.c. auto-reclosing relays. Town Clerk, City Hall, Brisbane. B.o.T. (ESB/9630/61).*

CONTRACTS PLACED

Hartlepool T.C. Electrical installations in: 30 houses Hart Station, John Westmoreland and Co., £1,667; new community centre, John Pounder Ltd., £1,129.

Hastings B.C. Supply of lamps/fittings for College of Further Education, A.E.I. Lamp and Lighting Co. Ltd., £2,570. Recommended.

Hendon B.C. Electrical installation in flatted factory, R. V. Griffiths and Co., £3,503. Recommended.

Hornsey B.C. Supply of sodium lamps for year, General Electric Co. Ltd., £5,011. Recommended.

Islington B.C. Electrical work at Tyndale Mansions and Wakelin Hse, Evans and Shea Ltd., £16,755. Recommended.

London C.C. Supply £169,859 and installation £51,803 of 60 passenger lifts, Express Lift Co. Ltd. (Not the lowest tender by £3,369, but difference to be offset in three years by lower running and maintenance costs.)

Luton B.C. Electrical installations: Central Depot, £7,391; 18 flats, Lensey estate, £1,196; Mead's Infants' School, £2,650, J. and J. Burtenshaw (Ptnrs) Ltd. Recommended.

Newcastle C.C. Electrical repairs in council houses for year, Gray Bros., £6,149.

Northumberland C.C. Rewiring of: Horsley Controlled School, Veale Nixon Ltd., £274; Red Row Primary School, £978 10s; and Seaton Delaval Primary School, £504 14s. Lighting improvements: Bedlington Station Secondary School, Mood and Sons, £315. Electrical installations: Forest Hall Secondary School, F. W. Johnson and Sons, £3,711; Hexham East Infants' School, W. M. Walker and Son, £718 9s. Recommended.

Scunthorpe B.C. Electrical installations in Riddings estate dwellings, Hobson and Scott Ltd., £874. Recommended.

Swansea C.B.C. Supply of steel columns for year, Abacus Municipal Ltd.

Warrington R.D.C. Provision and installation of A.57 street lighting comprising 73 Class "A" and seven Class "B," Eleco. mended.

BUSINESS PROSPECTS

Aberdeen. Kittybrewster (Paper) Ltd. plan factory extensions. Surveyors: D. I. Burchell and Ptnrs., South Tay St, Dundee.

Accrington. Manchester Hospital Board propose replacement of Rough Lee maternity home in grounds of Accrington Victoria Hospital.

Barrow. Planned: office block, Newland St, for Jas. Fisher and Sons, Strand.

Basildon D.C. Tender: 18 nursery factories, No. 2 industrial site. Corp. architect, Gifford Hse.

Bridlington. Leeds Regional Hospital Board, Harrogate, plan Bempton La Hospital.

Brighton. Wm. Willett (Contractors) Ltd., Sloane Sq, S.W.1, contractors for £47,712 factory at The Hyde, Lower Bevendean; Jaycee Furniture Ltd., Regent Hill, propose factory, North Woddingdean; Horsell Electrics Ltd., 47 Hollingdean Rd, propose factory.

Bristol. E. Whitmarsh-Everiss, Hanbury Rd, Clifton, architect for Bristol Repetition factory, Grafton St; Wilkins and Coventry Ltd., Cumberland Rd, contractors for Creech and Co. factory/offices; Bristol Commercial Vehicles, Bath Rd, Brislington, propose assembly shops/stores/offices, Bath Rd; Turner and Son, Stephen St, architects for Dattson and Knight factory extensions; W. Butler and Co., Silverthorne La, propose new chemical works.

Burbage. Iway Hosiery Co. propose Hinkley Rd factory extensions.

Camberley. All Wheel Drive, Queen Mary Ave, propose to acquire hangar at Blackbushe Airport and convert to factory at cost of £300,000.

Cardiff R.D.C. Tender: 25 aged persons' flats, Hollybush estate, Whitchurch. Engineer.

Cardigan. J. E. Cardwell and Co. Ltd., Primrose Wks, Heaton Moor, Stockport, propose new factory, Lampeter.

Chelmsford. Marconi International Marine Communications Co. propose H.Q. building. Architects: F. J. Taylor, Son and Bracken, New London Rd.

Cheshire. Henry Boot Group, Eccleshall Hall Rd South, Sheffield, propose several factories at Winsford. C.C. propose £24,676 health clinic, Grappenhall. County Architect.

Chester. Moore and Brock Ltd., The Quarry, Handbridge, plan new premsies, Sealand trading estate.

Cleethorpes T.C. £17,539 snackbar/shops/shelter proposed for Pier Gdns. Surveyor.

Croydon. Holts Products Ltd., Vulcan Way, propose factory extensions.

Darlington. Elliott, Cox and Ptnrs., Buckingham Palace Rd, S.W.1, architects for proposed Thameside Properties warehouse, Aycliffe.

Derbyshire C.C. H. Baggaley Ltd., Mansfield, awarded contract for new £171,576 county secondary school, Heath; Geo. Longden and Sons Ltd.'s £250,352 tender for Chesterfield College of Technology provisionally accepted subject to certain likely reductions.

Eastbourne. Y. J. Lovell (Sussex) Ltd. awarded £81,834 contract for Birds Eye Foods process building and ancillary works.

East Suffolk C.C. Tender: 27,000 sq ft modern school, Bacton, Stowmarket. County Architect, Ipswich.

Edinburgh C.C. Tender: 24 houses in two blocks, Wardieburn Dr; also tender for: 19 houses, 38 shops, in reconstruction of Whitehorse Close. City Architect.

Esher U.D.C. Tender: 33 old people's dwellings, Upper Farm estate, West Molesey. Engineer.

Forres B.C. Tenders: Castlehill East housing development: one terrace 12 three-roomed houses, two blocks of three single-room cottages.

Gillingham. Proposed: glove factory at Buckingham Rd, by Chester Jeffries Ltd., Bradford Rd, Slough.

Glasgow C.C. Tender: cleansing depot, Easterhouse. City Architect. Tender: several works, youth centre, Castlemilk Dr, Castlemilk. City Architect.

Gloucester C.C. Plan erection of industrial centre for mentally handicapped, Princess Elizabeth Way, Cheltenham.

Godmanchester. Cromwell Development Co. propose hotel/service station, Old Court Hse site; and shops/maisonnettes, Old Court Hall and West St.

Greenwich M.B.C. Tender: 54 flats and maisonnettes, Lansdowne La. Engineer.

Hamilton B.C. Tender: several works, 56 houses, Townhill Rd; and 23 houses, Fereneze Cres. Architect.

Huddersfield. George, Trew and Dunn, Eastbourne Terr, W.2, architects for second phase of general hospital at Green Leas.

Keighley. H. V. Robinson Ltd., Strawberry St, contractors for £250,000 40,000 sq ft extensions to Keighley Lifts factory, Dryart Wks.

Lindsey C.C. Propose new county secondary modern school, Kelling St, North Somercotes. County Architect, Lincoln.

Liverpool. Regional Hospital Board, Castle St, plan: general hospital, Fazackerley; third phase of Greaves Hall Hospital to cost £750,000; third phase of radio-therapy development, Clatteridge Hospital, costing £850,000; regional neurosurgical unit, Walton Hospital (£900,000); psychiatric rehabilitation unit, Fazackerley, to cost £850,000; and maternity unit at Chester City Hospital, costing £600,000.

London Airport. Corob Hldgs. Ltd., Hill St, Mayfair, proposed £1 million 300-room hotel, Bath Rd.

Loughborough. Sketchley Ltd., Hinckley, propose redevelopment of 9, 10, 11 Cattle Market.

Melton Mowbray U.D.C. £250,000 housing scheme for 178 dwellings, Kirby La estate, to proceed. Surveyor.

Northants C.C. Bosworth and Wakeford Ltd., Rugby, awarded £60,319 contract for extensions to Roade Secondary Modern School; Drabble Construction Ltd., Wellingborough, awarded £61,341 contract for new infants' school, Corby.

Oxford. Planned: warehouse/offices/showrooms, Paradise St, for G. R. Cooper (Oxford) Ltd.; extensions, Walton Well Rd, proposed by W. Lucy and Co. Ltd.

Peterborough C.C. Ruddle and Wilkinson, Long Causeway Chmbrs, architects for proposed four-storey blocks, maisonnettes, six-storey blocks flats, St. Mary's St.

Poole. The Wessex Regional Hospital Board, Winchester, propose 500-bed hospital for mentally sub-normal patients.

Pontypool U.D.C. Tender: 94 traditional dwellings, Trevethin. Architect.

Portsmouth. Planned: factory/offices, Fitzherbert Rd, Farlington, for Land and Commercial Holdings Ltd.; two factories at Fitzherbert Rd, Farlington, for J. H. Day Ltd., bldrs, Woodfield Ave, Farlington.

Purfleet. Work to begin on construction, machine house for Thames Board Mills. Contractors, Holloway Bros (London) Ltd., Millbank, S.W.1. Cost £1,500,000.

Reading. Proposed by Robert Cort and Son, Elgar Rd, factory extensions. Davis Estates Ltd., Kilburn High Rd, N.W.6, plans showrooms/offices at Crown St. Offices planned South St, East St for R.G.L. Investments Ltd. Architects: Chaplin and Burgoine, 4 Cathedral Close, Norwich. Extensions proposed by Prudential Assurance Co. Ltd., Holborn Bars, E.C.1.

Runcorn. Research laboratory, Runcorn Heath, proposed by I.C.I.

St. Austell (Cornwall). The South Western Regional Hospital Board, Bristol, plan first phase of new district hospital for St. Austell comprising maternity unit and staff quarters. Cost: £145,000.

Salford. Extensions and rebuilding of soap works proposed for Cussons, Sons and Co. Ltd., Kersal Vale Wks, Broughton, Manchester 7 (£69,000).

Scarborough. Planned: erection factory Cayton Rd, Eastfield, for D. H. Greaves Ltd., Oriel Wks, Scarborough.

Sheffield. Regional Hospital Board to convert X-ray unit to physio and occupational therapy unit; W. J. Simms, Sons and Cooke, contractors for £200,417 development, Aston Hall Hospital, Haydn Rd, Sherwood.

Shropshire. County Council proposes to erect old people's homes at Shrewsbury, Donnington and Oswestry. County Architect, Shrewsbury.

Skegness. Proposed: factory for Steibel and Co., Nescon Mill, Back Rd.

Skipton R.D.C. Tenders: 12 pairs bungalows, Beanlands estate, Glusburn. Engineer.

Slough. Proposed: R.C. school, Langley, cost £63,837; factory at Bath Rd, proposed for ExLax Ltd., trading estate, Slough, architects, Rix and Rix, High St, Burnham, Bucks; bindery bldg for Kenion Press Ltd., architects, G. Langley Taylor and Ptnrs, King's Bench Walk, E.C.4; new premises for Intertype Ltd., Farnham Rd, Slough; Starch Products Ltd., Slough, to have laboratory/offices erected by Fassnidge, Son and Norris Ltd., Uxbridge, Middx.

Stockport B.C. Tender: eight-storey electrical engineering and communal block, two-storey assembly block, Stockport College of Further Education. Architect.

Stockton. Proposed: St. Mary's R.C. secondary school, cost £180,000. Architect: T. A. Crawford, Borough Rd, Middlesbrough.

Sunderland. Proposed engineering factory for Hepworth and Grandage Ltd., St. John's Wks, Bradford 4.

Swanscombe. Empire Paper Mills Ltd., Greenhithe, propose new works and overhead bridge.

Thetford. Goddards of Thetford Ltd., Station Rd, to erect factories for J. W. Blight and Co. Ltd., Betstyle Hall, Carlisle Pl, N.11, and for Gurnett Lyons Ltd.

Thorne. R.D.C. Council propose £60,000 new offices. Surveyor. Doncaster Co-op. propose £200,000 60,000 sq ft American style supermarket.

Wakefield. Plans for shops Kirkgate for Central Commercial Properties Ltd., Cotton, Ballard and Blow, Waterloo St, Birmingham 2, architects.

Wandsworth M.B.C. Tender: 308 dwellings in 2, 4, 5, 6 and 14-storey blocks, Beaumont Rd. Clerk.

Warwickshire. C.C. Health Committee proposes a clinic and flats at Warwick, £40,550. A junior training centre at The Limes, Stratford-on-Avon. A youth centre at Kingshurst, £42,300, and at Castle Bromwich, £20,100.

Washington U.D.C. Tender: 42 houses, Village La. Engineer.

Watford. R. and J. Beck, optical instrument manufacturers, propose factory/office block at Bushey Mill La premises.

Welwyn Garden City (Herts). Work has now begun on the erection of new blocks at the National Spastic Society Training Centre, Digswell. Architects: Paul Mauger, Gavin, Mathers and Mitchell, 31 Church St. Welwyn Garden City. Contractors: Field Davis Ltd., 683 High Rd, London N.12. Cost: over £1 million. Herts C.C. has placed a £64,670 contract for erection of a home for aged and infirm at Woodall, with T. and B. (St. Albans) Ltd., 69 Victoria St, St. Albans.

Wigan C.B.C. Tender: 43 houses, Drummond Sq, Laithwaite. Engineer.

Wolverhampton. Corporation has plans for the Oxley special training centre, for which site works and building will cost £76,350.

Worthing. Proposed 14 shops, with offices, 43 flats, at Muir House site, for Park Investments Ltd., Park La, W.1.

Wortley R.D.C. Tender: nine blocks of flats, Oughtibridge, nr. Sheffield. Engineer.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

F. G. Brownings (Sussex) Ltd., 66 Clyde Rd, Brighton 7. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dir.: Frederick G. Brownings.

Bunting McConnell and Co. Ltd., Prospect Hill, Kidderminster. Electrical accessories manufacturers and dealers, etc. Nom. cap.: £100. Dirs.: Samuel B. Smith and June V. Smith.

D. G. Davies (Electrical) Ltd., 14 Lucas Rd, Glais, Clydach, nr. Swansea. Nom. cap.: £100. Dirs.: Wyne Davies, Dorothy G. Davies and Elizabeth M. Davies.

Direct Rentals Ltd., 11 Tooting Bec Gdns, S.W.16. Vacuum cleaner manufacturers and dealers, etc. Nom. cap.: £1,000 Permanent dirs.: James H. Boots, Donald Sherriff and Alan Cox.

Doplu Exports Ltd., 4 Throgmorton Ave, E.C.2. Manufacturers, exporters and importers of and dealers in domestic and scientific electrical appliances, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: R. H. V. Dixon and A. G. Staplehurst.

Douglas and Dene Ltd. To carry on business of general, constructional, electrical and mechanical engineers, etc. Nom. cap.: £1,000. Dirs.: James A. L. Douglas and Elizabeth W. Douglas. Subs.: Geo. A. Crook, 51 Caversham Ave, Palmers Green, N.13; and Emily Faulkner.

Duke and McBride Ltd., 2 Glebelands Rd, Sale, Ches. To carry on business of electrical contractors and engineers, manufacturers of and dealers in radio and television sets, etc. Nom. cap.: £100. Dirs.: Hugh Duke and Bernard R. McBride.

Eastman Electric Ltd., 177 Percy Rd, Hampton, Middx. Manufacturers of and dealers in vacuum cleaners, sewing machines, etc. Nom. cap.: £100. Dirs.: Wm. J. Eastman and Mrs J. K. Eastman.

Electrical Rewinding Services (York) Ltd. To take over the electrical rewinding section of the business carried on by York Autoelectrics Ltd., etc., 2a Lead Mill La, Piccadilly, York. Nom. cap.: £2,000. Dirs.: Cecil T. Marks and Wm. C. Bower.

Wm. Evans (Electrical) Ltd., 117 Golden Ave, Cardiff. Nom. cap.: £1,000. Dirs.: Wm. Evans and Kimble V. Evans.

E. Finch and Son (Electrical) Ltd., 7 Warmdene Rd, Patcham, Brighton 6. Nom. cap.: £1,000. Permanent dirs.: Ernest R. G. Finch, Violet A. Finch and David J. Finch.

Foulkes Electrical Ltd., 12 Birtles Rd, Warrington. Nom. cap.: £1,000. Dirs.: Harry Dutton and Mrs Amelia M. D. Foulkes.

J. G. Gibbons and Sons Ltd., 136 Conway Rd, Colwyn Bay, N. Wales. Electrical engineers and contractors, engineers, etc. Nom. cap.: £2,000. Dirs.: John G. Gibbons and Winifred Gibbons.

Hepworth Electrical Developments Ltd. Nom. cap.: £100. Dirs.: John F. Booth, Hazlehead Hall, Penistone; Peter Hinchliff and Walter Newman.

A. H. Horton Ltd., 1 St. Mary's St, Bridgnorth, Salop. To carry on business of electrical contractors, etc. Nom. cap.: £2,000. Dir.: Arthur H. Horton.

Hotfoil Ltd. To carry on the business of electrical, mechanical and general engineers, etc. Nom. cap.: £100. Dirs.: not named. Subs.: D. V. Jennings and G. T. Sammons, both of 9-12 Cheapside, E.C.2.

I.G.A. (Electronics) Ltd., 48 Station Rd, Harrow. Nom. cap.: £1,000. Dirs.: Roy H. Brett and Elizabeth J. Brett.

Lewis Electrical Heating Automatics Ltd., 3 North Way, Montagu Rd. N.9. To take over business carried on as "Lewis Electrical Heating Products" at 44a West Green Rd, N.15, etc. Nom. cap.: £2,000. Dirs.: Charles R. J. Lewis and Ruby C. Lewis.

Melvin Electric Co. (Southport) Ltd., Melvin Hse, Bath St North, Southport. Nom. cap.: £2,000. Dirs.: A. and J. M. Samuels.

J. F. Milward Ltd. Electrical equipment manufacturers and dealers, etc. Nom. cap.: £1,500. Dirs.: to be appointed by subs. Subs.: Dorothy M. Graeme and Paul G. Graeme, 61 Fairview Ave, Gillingham.

John R. Morgan (Electrical) Ltd., 87 Lord St, Liverpool 2. Nom. cap.: £100. Dirs.: John R. Morgan and Andrena S. Morgan.

Otabbox Ltd. To carry on business of electrical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and Thos. A. Herbert, 156 Strand, W.C.2.

Raymond and Tyler Ltd., 23 Bull Head St, Wigston Magna, nr. Leicester. Electrical contractors and manufacturers, etc. Nom. cap.: £1,000. Dirs.: Raymond Tyler and Mrs Ella Tyler.

Rem Products (Electrical) Ltd., 293 London Rd, Hadleigh, Essex. Nom. cap.: £100. Dirs.: Leonard F. Mooney and Mrs I. M. Mooney.

Trafalgar Electrical Co. Ltd., 127 Queen Victoria St, E.C.4. Nom. cap.: £1,000. Dirs.: Margaret L. Geary and Kenneth Clancy.

Vacuum Cleaner Replacements Ltd. Nom. cap.: £1,000. Dir.: Barbara E. Bradley. Subs.: Mrs Joan D. White, 3 Birch Grove, Lee, S.E.12; and Gordon L. W. Hillier.

Vidaire Electronics Ltd., 8 Southampton Row, W.C.1. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Lesley Kates and Harvey Kates.

S. J. Watson (Electrical) Ltd., 1 and 2 The Pantiles, Biggin Hill. Nom. cap.: £15,000. Dirs.: Sidney J. Watson and Kathleen G. Watson.

GAZETTE ANNOUNCEMENTS

BANKRUPTCY ACTS

Appointment of Trustees

Bangor. L. Nadin, radio, television and electrical retailer, formerly carrying on business as Nadins, at 1 Vaughan St, Station Sq, Llandudno; Back Madoc St, Llandudno; and at Oakland Hse, High St, Penmaenmawr; also at 59 Albergele Rd, Colwyn Bay; and Denbigh St, Llanrwst. Mr R. A. Hawken, Bank Chmbrs, 1 John St, W.C.1, appointed trustee as from 13 March.

Colchester. F. H. Saul, electrical goods and furniture retailer, carrying on business as Holland Domestic Supplies, at 3 King's Ave, Holland-on-Sea. Mr R. A. Paterson, Archdeacons Hse, Northgate St, Ipswich, appointed trustee as from 15 March.

Durham. C. E. W. A. Loerns, electrical retailer, carrying on business as C. and P. Lawn at 37 Hope St. Mr E. Taylor, 30-32 Grey St, Newcastle, appointed trustee as from 9 March.

Chesterfield. A. Robinson, electrician, carrying on business at 47a Newbold Rd. Mr P. Cardwell, 93 Queen St, Sheffield, appointed trustee as from 22 March.

Walsall. E. E. Berrill, electrical goods and furniture dealer, carrying on business as Erica Furnishers and Electricals at 46A Bradford St. Mr K. D. Wickenden, Stoneleigh Chmbrs, 2 Queen's Rd, Coventry, appointed trustee as from 22 March.

Release of Trustees

Bradford. M. R. Dixon, plumber and electrical retailer, carrying on business as at 36 Pearson St. Trustee: G. E. Rushton, 36 North Parade, Bradford 1, released as from 9 March.

Halifax. G. Jones, patentee of electrical equipment, carrying on business as G. Jones and Sons, at 100 Furness Drive, Illingworth. Trustee: J. L. Williams, 20 North Parade, Bradford 1, released as from 13 March.

Workington and Cockermouth. A. Armstrong, electrical goods factor, of 62 Lawson St, Maryport. Trustee: D. Atkinson, 14 Lowther St, Carlisle, released as from 6 March.

Application for Discharge

High Court of Justice. K. W. Roberts, electrical goods dealer, formerly carrying on business as K. Roberts Electrical, at 1-3 Oglander Rd, S.E.15. Application for discharge to be heard at Bankruptcy Bldgs, Carey St, W.C.2, on 21 April, at 11 a.m.

High Court of Justice. J. C. A. Drew, electrical goods dealer, formerly carrying on business as K. Roberts Electrical at 1-3 Oglander Rd, S.E.15. Order made on 12 Jan. on application for discharge: discharged as from 12 May.

Norwich. W. B. McKelvey, electrical contractor, carrying on business at 2 High Rd, Drayton. Application for discharge order made on 20 Feb.: discharged as from 6 March.

COMPANIES ACTS

Cerrigydrudion Electricity Supply Co. Ltd. Creditors to send details to liquidator: J. V. Banks, 17 Crescent Rd, Rhyl, by 15 April. Formal notice: all creditors to be paid in full.

Alvis Electrical Co. Ltd. Mr G. H. Eaves, 47 Mosley St, Manchester 2, appointed liquidator at extraordinary general meeting on 15 March for the purpose of voluntarily winding-up.

Ilmace Ltd. Mr A. E. Pritchard-Fellows, 45 Upton Rd, Bexleyheath, Kent, appointed liquidator at extraordinary general meeting on 9 Feb. for the purpose of voluntarily winding-up.

Derwent Exports (London) Ltd. Last day for receiving proofs for intended dividend: 7 April, by liquidator: H. W. Pitt, 100 Park St, W.1.

Solihull Trading Co. Ltd. Creditors to send details to liquidator: R. F. Bendall, 126 Colmore Row, Birmingham 3, by 29 April.

W. Doubleday Ltd. Creditors to send details to liquidator: R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, by 10 April.

Alan Breck Ltd. Creditors to send details to liquidator: R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, by 15 April.

C. and D. Electrics (Camelford) Ltd. Mr E. J. Trudgeon, of Metherell Gard and Co., Wadebridge, appointed liquidator at extraordinary general meeting on 17 March for the purpose of voluntarily winding-up.

Star-Lite Mnfg. Co. Ltd. Mr A. W. Garnier, 8 Queen St, Cheapside, E.C.4, appointed liquidator at extraordinary general meeting on 17 March for the purpose of voluntarily winding-up.

Home Appliances (J. E. Bell) Ltd. Mr K. Russam, 2 Manor Row, Bradford 1, appointed liquidator at extraordinary general meeting on 17 March for the purpose of voluntarily winding-up.

R. Brock Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 17 April. Persons intending to appear to notify Kimbers, 34 Nicholas La, E.C.4, by 4 p.m. 15 April.

A. V. Contracts (Cockfosters) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 17 April. Persons intending to appear to notify J. Sanson, 45 Chancery La, W.C.2, by 4 p.m. 14 April.

Harrisons (Electrical and Refrigeration) Ltd. Mr M. Collier, 199 Piccadilly, W.1, appointed liquidator at extraordinary general meeting on 14 March for the purpose of voluntarily winding-up.

Stead and Firth Ltd. Mr M. S. Walker, 43 Cheapside, Bradford 1, appointed liquidator at extraordinary general meeting on 23 March for the purpose of voluntarily winding-up.

MEETINGS TO NOTE

THURSDAY, 6 APRIL

I.E.E. "Technical and Economic Aspects of the Supply of Reactive Power in England and Wales," W. Casson and H. J. Sheppard. Savoy Pl, W.C.2. 5.30 p.m.

INSTITUTION OF CIVIL ENGINEERS. "River Utilisation and the Preservation of Migratory Fish Life," G. Baxter. Gt. George St, S.W.1. 5.30 p.m.

PLASTICS INSTITUTE (Southern). "Recent Developments in the Use of Acetal Resins," G. F. C. Barrett. Chemistry Dept., University of Southampton. 7.30 p.m.

I.E.S. (Nottingham). "Ship Lighting." A. E. Fothergill. Electricity Centre, Carrington St. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Television Group). Discussion: "Transistorised Television Receivers." London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N.W. Section). "Plant Investigation and Control Using Digital Techniques," K. J. McCarthy. Reynolds Hall, College of Technology, Manchester 1. 7 p.m.

I.E.E. (Bristol Graduates and Students). "Transformer Development," F. G. Pratt. Electricity Hse, Colston Ave. 7 p.m.

INTERNATIONAL AUDIO FESTIVAL AND FAIR at Hotel Russell, W.C.2, until 9 April.

A.S.E.E. (Brighton, Hove and District). "Electrical Application to the Paper Industry," A. Castle. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

FRIDAY, 7 APRIL

I.E.E. (Medical Electronics Group). Discussion: "The Conversion of Biological Data into Electrical Signals." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Southern). "Subscriber Trunk Dialling," D. A. Barron. S.E.B. Showrooms, Newport, I.o.W. 6.30 p.m.

I.E.E. (Southern). Annual dinner/dance. Old Ship Hotel, Brighton.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). A.G.M. Admin. Bldg, Esso Refinery. 5.30 p.m.

A.S.E.E. Annual dinner at Grosvenor Hse, Park La, W.1.

MONDAY, 10 APRIL

I.E.E. (Electronics and Communications Section). Discussion: "Applications of Electrical Phenomena at Liquid Helium Temperatures." Savoi Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). A.G.M. and "The Mechanism of Lightning," Professor J. M. Meek. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). A.G.M. and "Some Aspects of the Application of Electronics to Medicine." Rutherford College of Technology, Northumberland Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands). "Development of 'Off-Peak Heating' with Particular Reference to Floor-warming," S. C. Dinenage. (Joint meeting with Supply and Utilisation Group.) College of Technology, Gosta Green. 6.30 p.m.

I.E.E. (Western). "Speed Changing Induction Motors—Further Developments in Pole-Amplitude Modulation," Professor G. H. Rawcliffe and W. Fong. Bristol University. 6 p.m.

N.E. ELECTRICAL CLUB. "Whisky," J. J. Priestley. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Manchester). "Industrial Application of TV." Nags Head, Jacksons Row. 6.45 p.m.

I.E.S. (Sheffield). A.G.M. and lighting forum. Grand Hotel. 6.30 p.m.

SOCIETY OF ENGINEERS. "The Use of Electric Light and Heat in Horticulture," A. E. Cranham. Geological Society, Burlington Hse, W.1. 5.30 p.m.

A.S.E.E. (Bolton). "Fire Alarm Systems," A. Whitehouse, Railway Hotel, Trinity St. 7.45 p.m.

A.S.E.E. (C. London). "Railway Electrification." White Hall Hotel, Bloomsbury Sq, W.C.1. 7.15 p.m.

A.S.E.E. (Essex). Chairman's invitation lecture. The Angel Hotel, Ilford Broadway. 8.15 p.m.

A.S.E.E. (Leeds). "The Aims and Objects of the N.I.C.E.I.C.," E. J. Sutton. Gt. Northern Hotel. 7.30 p.m.

A.S.E.E. (N.W. London). "Transistors and Other Semiconductor Devices," D. D. Jones. Century Hotel, Wembley. 8.15 p.m.

A.S.E.E. (Sheffield). "Heavy Industrial Control Gear," C. V. Curran. Royal Victoria Hotel. 7.30 p.m.

TUESDAY, 11 APRIL

I.E.E. (Measurement and Electronics Sections). "Precision Instruments for Coaxial Line Measurements up to 4Gc/s," D. Woods; and "The Concept of Equivalent Source E.M.F. and Equivalent Available Power in Signal-Generator Calibration," D. Woods. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (E. Midlands). "The Power Drive and Control for Jodrell Bank Radio Telescope," C. N. Kington, H. A. Prime and H. T. Price. Lecture Theatre, Portland Bldg, Nottingham University. 6.30 p.m.

I.E.E. (N. Midlands). "Some Notes on the Electrical Requirements of General Cargo Docks," E. R. Radway. Royal Station Hotel, York. 7 p.m.

I.E.E. (N. Western). "The Impulse Strength of Impregnated-Paper Dielectrics as Used in High Voltage Cables," B. F. Salvage and J. A. M. Gibbons. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

I.E.E. (N. Ireland). "Research on the Performance of High Voltage Insulators in Polluted Atmospheres," J. S. Forrest, P. J. Lambeth and D. F. Oakeshott. Civil Engineering Dept., David Keir Bldg, Queen's University, Stranmillis Rd, Belfast 9. 6.30 p.m.

INSTITUTION OF PLANT ENGINEERS (London). "Plant Engineering on the Continent." Royal Society of Arts, John Adam St. 6.30 p.m.

I.E.E. (N. Midlands Graduates and Students). "Machine Tool Electrics," B. S. Parker. Y.E.B. Offices, Sunbridge Rd, Bradford 1. 7 p.m.

I.E.E. (N. Staffs Graduates and Students). "Auxiliary Power Systems for Nuclear Power Stations," R. Ball. At Stafford. 7.30 p.m.

INTERNATIONAL REFRIGERATION AND AIR CONDITIONING EXHIBITION at Earls Court until 14 April.

I.E.E. (Southern). "High Speed Pulse Techniques Using Transistors," E. Wolfendale. University, Southampton. 6.30 p.m.

I.E.S. "The New I.E.S. Lighting Code," Dr W. E. Harper. I.E.E., Savoy Pl, W.C.2. 5.30 p.m.

A.S.E.E. (Chester and District). "Electric Floor-warming and Allied Applications of Heating Cables," K. W. Ballamy. Westminster Hotel, City Rd. 7.45 p.m.

A.S.E.E. (Leicester). "Floor-warming and Ancillary Equipment," K. W. Ballamy. Westcotes Constitutional Club, Wilberforce Rd. 7.30 p.m.

A.S.E.E. (Portsmouth and District). "Signalling and Control System as Used by London Transport." Committee Rooms, Ministry of Labour Offices, Lake Rd. 7.30 p.m.

WEDNESDAY, 12 APRIL

I.E.E. (Supply Section). "The Calculation of the Magnetic Field of Rotating Machines—Part 2—The Field of Turbo-Generator End-Windings," D. S. Ashworth and P. Hammond; and "The Magnetic Field of the End-Windings of Turbo-Alternators," P. J. Lawrenson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Education Circle). Discussion: "Teaching Physics to Engineers." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N. Lancs). "The Provision of Adequate Electrical Installations in Buildings—Small Industrial Premises," J. A. Sharp. N.W.E.B. Lecture Theatre, Jubilee St, Blackburn. 7.30 p.m.

I.E.E. (S. Western). "The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor," Professor F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Piggott. Plymouth "B" Generating Station, Prince Rock, Plymouth. 3 p.m.

I.E.E. (S.W. Scotland). "Measured and Electrical Model Characteristics of Buildings Heated by Floor Thermal Storage," E. D. Taylor, B. Berger and G. Blaylock. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

WOMEN'S ENGINEERING SOCIETY (London). "Road Research," Miss Sabey. "Hope House," 45 Great Peter St, Westminster, S.W.1. 7 p.m.

I.E.S. Annual dinner and dance. Criterion Restaurant, Piccadilly Circus, W.1.

NEWPORT AND DISTRICT ELECTRIC CLUB. "Survey of Practical Applications of Electronics," D. J. A. Carswell. King's Head Hotel, Newport, Mon. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "Vibration Analysis and Testing," D. E. Mullinger. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N.E. Section). A.G.M. and "Colour Television," G. N. Patchett. Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Rd, Newcastle. 6 p.m.

A.S.E.E. (Birmingham). "Medium Voltage Distribution Gear: Current Practice and Future Trends," J. H. Rowley and J. R. Watkin. Birmingham Exchange and Engineering Centre, Stephenson Pl. 7.30 p.m.

A.S.E.E. (Luton). "Closed Circuit Television." Luton College of Technology, Park Sq. 8.15 p.m.

THURSDAY, 13 APRIL

I.E.E. Seventh Graham Clark Lecture. (Joint meeting with Civils and Mechanicals.) "Resources Human and Material of the Commonwealth," H.R.H. Prince Philip. Gt. George St, S.W.1. 5.30 p.m.

I.E.E. (N. Lancs). "The Provision of Adequate Electrical Installations in Buildings—Small Industrial Premises," J. A. Sharp. N.W.E.B. Demonstration Theatre, Duke St, Barrow. 7.30 p.m.

I.E.E. (W. Wales). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. Conference Room, S.W.E.B., The Kingsway, Swansea. 6 p.m.

I.E.E. (N. Scotland). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Electrical Engineering Dept., Queen's College, Dundee. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). Address by R. S. Medlock. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

I.E.S. (Manchester). A.G.M. Demonstration Theatre, N.W.E.B. Town Hall Extension. 6 p.m.

DIESEL ENGINEERS AND USERS' ASSOCIATION. Annual luncheon. Connaught Rooms, London.

I.E.E. (Sheffield Graduates and Students). "The Use of Electricity in Hazardous Atmospheres," P. A. D. Sheen. College of Technology, Doncaster.

A.S.E.E. (Bradford and District). "Eddy-current Controlled Slip Couplings as Drives and Tension Brakes," R. H. Wheat. Midland Hotel. 7.30 p.m.

A.S.E.E. (Oxford and Districts). "Radio-Astronomy," Dr A. D. Petford. Reactor School, A.E.R.E., Harwell. 5.45 p.m.

FRIDAY, 14 APRIL

I.E.E. (Sheffield). Annual dinner/dance. Victoria Hotel, Sheffield. 7.30 p.m.

I.E.E. (N. Scotland). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

I.E.E. (N.E. Graduates and Students). "Noise: Its Effects, Measurement and Control," J. R. Anderson. Grey Hall, King's College, Newcastle upon Tyne. 6.30 p.m.

E.P.E.A. Annual dinner. Palmerston Restaurant, Bishopsgate.

SOCIETY OF INSTRUMENT TECHNOLOGY (Midland). A.G.M. Lecture Theatre, Byng Kendrick Suite, Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

MONDAY, 17 APRIL

I.E.E. Discussion: "The Education of Engineers—All's Well?" Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). A.G.M. and Conversazione. Royal Station Hotel, Newcastle upon Tyne. 6.30 p.m.

I.E.E. (N. Staffs). "The Potentialities of Artificial Earth Satellites for Radiocommunication," W. J. Bray. Duncan Hall, Stone, Staffs. 7 p.m.

I.E.E. (Southern). "Progress in Oil-filled Cables and Their Accessories," A. N. Arman, F. J. Miranda and G. R. Bishop; and "The Influence of Ageing on the Characteristics of Oil-filled Cable Dielectrics," P. Gazzana-Priaroggia, G. L. Palandri and U. A. Pelagatti. The Technical College, Brighton. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). A.G.M. and "Hydraulics v. Electrics." D. Firth. Royal College of Science and Technology, Glasgow. 6 p.m.

I.E.E. (Western Supply Group). "The Operation of Large Electrical Supply Systems," L. B. Law. South Wales Institute of Engineers, Park Pl, Cardiff. 6 p.m.

BIRMINGHAM ELECTRIC CLUB. "Ceramics for the Electrical Industry," E. C. Williams. Grand Hotel. 6.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). A.G.M. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

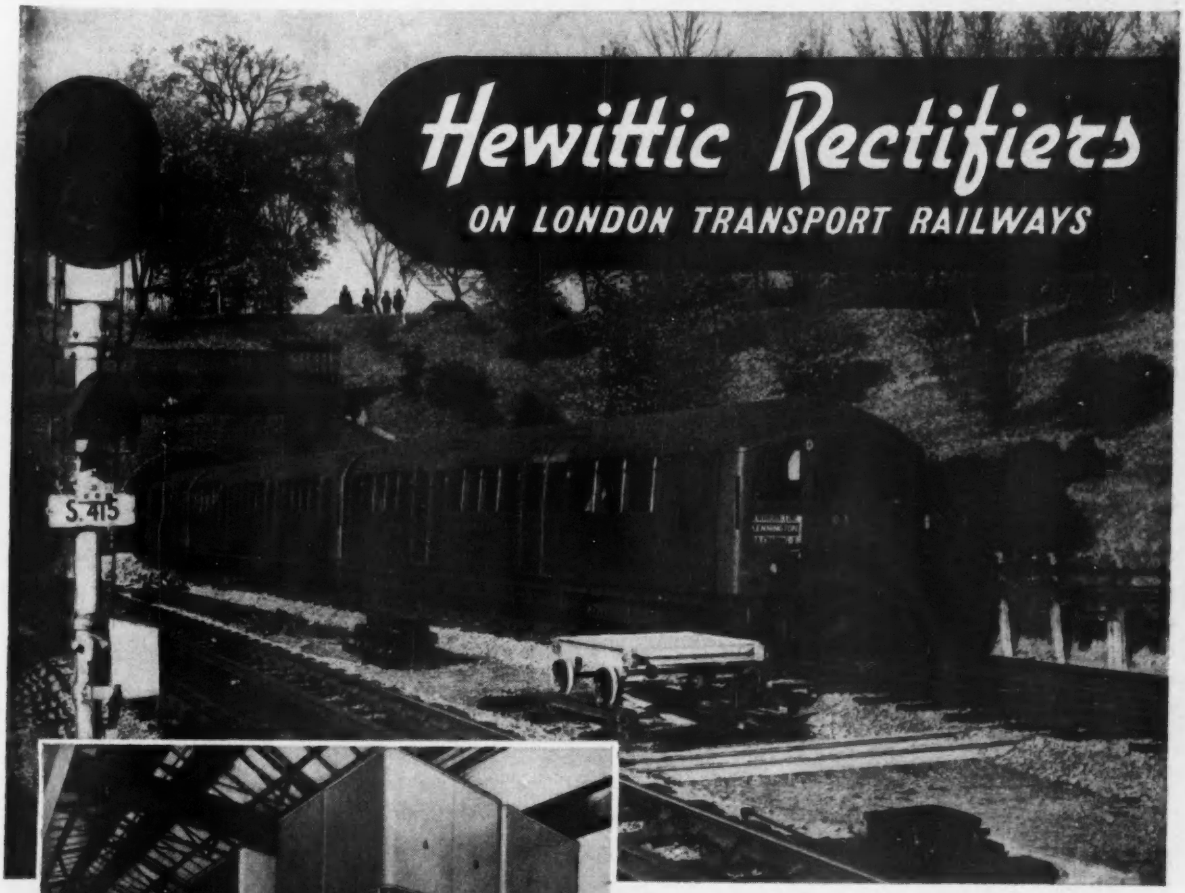
I.E.S. (Bath and Bristol). A.G.M. Gardiner, Sons and Co. Showroom.

I.E.S. (Leeds). "The Artistic Use of Lighting in Multi-camera Technique," H. E. H. Mayhew. British Lighting Council, 24 Aire St. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "The Future of Television in Britain," T. A. H. Marshall. Electric Hse. 7.15 p.m.

E.D.A. RURAL ELECTRIFICATION CONFERENCE at Sutton Bonington until 21 April.

I.E.E. (Cardiff Graduates and Students). A.G.M. and "The Engineer as Manager," J. E. Cule. South Wales Institute of Engineers, Cardiff. 7 p.m.



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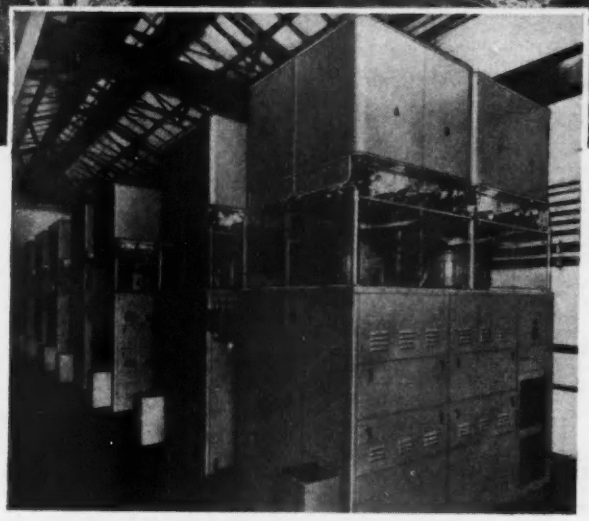
ON LONDON TRANSPORT RAILWAYS



The illustrations show a train on the Northern Line at Hendon and the 4,000 kW substation at Bond Street (Central Line) equipped exclusively with Hewittic Rectifiers. The plant comprises four 1,000 kW combined rectifier and transformer units, the transformers being totally enclosed air-cooled. This Company is also responsible for the supply and installation of all A.C. and D.C. control gear at this substation. Some 90,000 kW of Hewittic Rectifiers have been supplied to the London Transport Executive.

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The Standardisation Bench is the heart of the electronic testing equipment which ensures extreme accuracy of calibration of all S 200 meters. A Laboratory Standard Wattmeter and a crystal controlled electronic timer, reading to 1/10th of 1 millisecond, are used for the daily checking of the Rotating Standard. d.c. potentiometers are installed for the regular checking of the Laboratory Standard Wattmeter.
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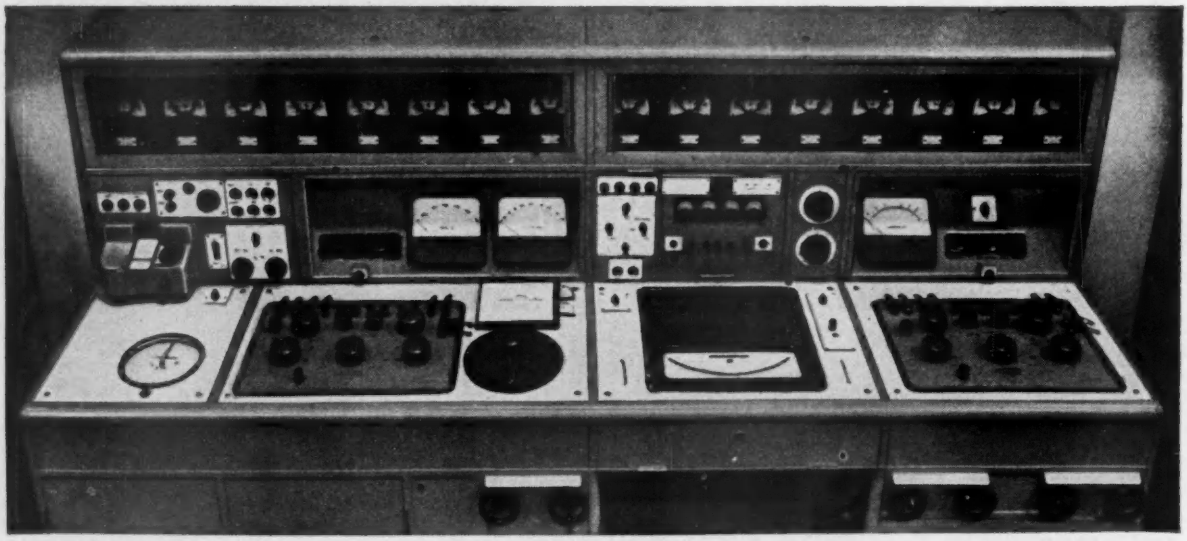

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(A 298)

TENDERS INVITED

COUNTY BOROUGH OF BURY
Class "A" Street Lighting

TENDERS invited for:

(a) Supply of 61 Steel or Concrete Columns, 30 ft to light source, together with 200 Watt Sodium Lanterns, Lamps, Control Gear and Time Switches.

(b) Erection and installation of above.

(c) Removal of 120 existing traction type standards, overhead lines, etc.

The above tenders are for Stage 1 of a six-year programme for the replacement and modernisation of street lighting installations on main traffic routes. The six-year programme provides for the supply and erection of approximately 700 new lighting columns and equipment, and the removal of approximately 900 existing traction type standards and equipment.

Further particulars, forms of tender, etc., from Street Lighting Superintendent, Street Lighting Department, Hacking St, Bury.

Tenders enclosed in a plain sealed envelope endorsed "Tender—Street Lighting" must reach me not later than 18 April, 1961.

EDWARD S. SMITH,
Town Clerk.

Town Hall,
Bury.
29 March, 1961. (A 316)

OTLEY URBAN DISTRICT COUNCIL
Installation of Group "A" Lighting

TENDERS are invited for the supply and erection of 50 (fifty) plain tubular steel street lighting columns and brackets, totally enclosed side entry lanterns, lamps, ancillary control gear and wiring for 250 watt and 400 watt colour-corrected mercury fluorescent lighting along a length of 1·069 miles in Pool Rd, Otley (route A659).

Forms of tender, Specification and Bills of Quantities may be obtained from the office of the Council's Engineer and Surveyor, North Parade, Otley, on payment of a deposit of £1 1s which will be refunded on receipt of a bona-fide tender not subsequently withdrawn.

Tenders, in a plain sealed envelope endorsed "Group 'A' Lighting," must be delivered to the undersigned not later than 12 noon on Saturday, 29 April, 1961.

The Council does not bind itself to accept the lowest or any tender received.

H. HALSTEAD,
Clerk of the Council.

Council Offices,
North Parade,
Otley,
Yorkshire.
27 March, 1961. (A 284)

COUNTY BOROUGH OF BLACKPOOL

TENDERS invited for the supply of the following equipment for the Lighting and Electrical Services Dept.:

120 Group "B" concrete columns.
120 Group "B" fluorescent lanterns and brackets.
150 Synchronous solar dial time switches.
30 Group "A" concrete columns and brackets.
30 Group "A" fluorescent lanterns.

Specifications, drawings, tender and general conditions from Director of Lighting and Electrical Services, Rigby Rd East, Blackpool, to be returned by 2.30 p.m., 24 April, 1961. (A 283)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD
London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (ELECTRICAL)
BRUNSWICK WHARF POWER STATION
Vacancy No. 61/188.

Applicants will be on Electrical Maintenance Staff to assist with testing of Station electrical plant and protective gear. Duties involve primary and secondary injection of current transformers and relays; pressure testing of H.V. cables, motors and switchgear; fault investigation, including electronics. Salary: Class K, Grade 12, £1,015 per annum.

Applications, quoting vacancy number, may be made to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London W.1, to be received not later than 18 April, 1961. (A 311)

CENTRAL ELECTRICITY GENERATING BOARD
London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (SHIFT RELIEF)
STEPNEY POWER STATION
Vacancy No. 61/187.

Sound technical training with some experience of power station operation. Duties include provision of shift relief, mainly in Control Room. Salary: Class F, Grade 12, £755/£845 per annum, plus £90 Shift per annum.

Previous applicants for Vacancy No. 61/93 need not re-apply.

Applications, quoting vacancy number, may be made to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London W.1, to be received not later than 18 April, 1961. (A 310)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Central Gloucestershire Area

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER
(DEAN FOREST)

The successful applicant will be required for duties in connection with the Contracting and Consumers' Service Section, and should have had experience in estimating for all classes of electrical installation work, the preparation of tenders and specifications. A sound knowledge of installation practice, refrigeration and electrical apparatus repairs, with good commercial ability is necessary. Technical qualifications desirable. Salary: £890/£1,015 per annum (N.J.B. Grade E.8). Apply, by letter, within 14 days, stating age, experience, present position and salary, to Mr S. Raybould, Area Manager, Midlands Electricity Board, Eastern Ave, Gloucester.

North Staffs Area

THIRD ASSISTANT DISTRICT ENGINEER
(LEEK/CONGLETON)

Duties include the construction, operation and maintenance of H.V. and M.V. Mains and Substations, and applicants should have had experience in the planning of system reinforcements and mains extensions. Salary: £965/£1,090 per annum (N.J.B. Grade G.9).

GENERAL ASSISTANT DISTRICT ENGINEER
(STAFFORD)

Applicants should have had a sound technical training and experience in construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable. Salary: £715/£805 per annum (N.J.B. Grade F.12).

GENERAL ASSISTANT ENGINEER (SURVEY)
(AREA OFFICE)

The successful applicant will be required to assist in survey and profile work. Salary: £715/£805 per annum (N.J.B. Grade L.17).

Apply, by letter, within 10 days, stating age, experience, present position and salary, to Mr C. C. Pimble, Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

F. W. CATER,
Secretary.
(A 318)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD
(East Midlands Division)

ASSISTANT ENGINEERS (CONTROL ROOM)
STAYTHORPE "A" POWER STATION
Vacancy No. 68/61.

APPLICATIONS are invited for the positions of Assistant Engineers (Control Room) at Staythorpe "A" Power Station, near Newark, Notts.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class K, Grade 14 (£825/£940 per annum), of the National Joint Board Agreement, plus an allowance whilst engaged on shift duties.

Closing date for receipt of applications: 14 April, 1961.

ASSISTANT COAL AND ASH HANDLING ENGINEER
SPONDON POWER STATION
Vacancy No. 69/61.

Applications are invited for the position of Assistant Coal and Ash Handling Engineer at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

The duties of the successful candidate will include the organisation of ash disposal by lorry transport.

Salary will be in accordance with Class J, Grade 10 (£1,040/£1,165 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 14 April, 1961.

SECOND ASSISTANT STATION CHEMIST
SPONDON POWER STATION
Vacancy No. 70/61.

Applications are invited for the position of Second Assistant Station Chemist at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil and with the interpretation and application of the analytical results.

Salary will be in accordance with Class J, Grade 11 (£965/£1,090 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 14 April, 1961.

ASSISTANT ENGINEERS (RELIEF)
SPONDON POWER STATION
Vacancy No. 71/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class J, Grade 12 (£890/£1,015 per annum), of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 14 April, 1961.

ASSISTANT COAL AND ASH HANDLING ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 72/61.

Applications are invited for the position of Assistant Coal and Ash Handling Engineer at Nottingham Power Station, Queens Drive, Nottingham.

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

The duties of the successful applicant will include the organisation of ash disposal by lorry transport.

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Salary will be in accordance with Class K, Grade 10 (£1,115/£1,245 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT EFFICIENCY ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 73/61.

Applications are invited for the position of Assistant Efficiency Engineer at Nottingham Power Station, Queens Drive, Nottingham.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

SECOND ASSISTANT STATION CHEMIST
NOTTINGHAM POWER STATION
Vacancy No. 74/61.

Applications are invited for the position of Second Assistant Station Chemist at Nottingham Power Station, Queens Drive, Nottingham.

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil, and with the interpretation and application of the analytical results.

Salary will be in accordance with Class K, Grade 11 (£1,040/£1,165 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT ENGINEERS (RELIEF)
NOTTINGHAM POWER STATION
Vacancy No. 75/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Nottingham Power Station, Queens Drive, Nottingham.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class K, Grade 12 (£965/£1,090 per annum), of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT ENGINEER (CONTROL) (RELIEF)
NOTTINGHAM POWER STATION
Vacancy No. 76/61.

Applications are invited for the position of Assistant Engineer (Control) (Relief) at Nottingham Power Station, Queens Drive, Nottingham.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class K, Grade 14 (£825/£940 per annum), of the National Joint Board Agreement, plus appropriate allowance whilst engaged on shift duties.

Closing date for receipt of applications: 21 April, 1961.

ASSISTANT SHIFT CHARGE ENGINEER
NOTTINGHAM POWER STATION
Vacancy No. 78/61.

Applications are invited for the position of Assistant Shift Charge Engineer at Nottingham Power Station, Queens Drive, Nottingham.

Applicants should preferably possess the Higher National Certificate or its equivalent, and have had responsible experience in the operation of modern power station plant. Pulverised fuel experience will be an advantage.

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Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 21 April, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(A 296)

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS

FOR design construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports.

SALARY according to age, quals. and exp. from £936 (at 25) to £1,430 max., with increase for London and slight decrease in country districts. In addition salary is increased by £75 p.a. (within the maximum of scale) after two years' approved service, subject to being corporate members of Institution of Mechanical or Electrical Engineers. Appointments long term with good prospects of pension and advancement to numerous posts in higher grades, viz.:

Mechanical and Electrical Engineers: £1,456/£1,950, 125 posts;

Senior Mechanical and Electrical Engineers: £2,080/£2,392, 34 posts;

Superintending and above Mechanical and Electrical Engineers: £2,650 upwards, nine posts.

Vacancies occurring in higher grades are filled by promotion of existing staff.

Good opportunities for acquiring exp. overseas where special allowances ranging at present up to £1,800 p.a., according to location and marital status, are payable in addition to higher salary. Five-day week with four weeks' two days' paid leave p.a. initially.

QUALS.: (a) University degree or equiv. diploma in electrical and/or mechanical engineering with at least two years' apprenticeship; or (b) Graduate or corporate member of I.E.E. with at least three years' apprenticeship; or (c) Graduate or corporate member of I.Mech.E. appreciable electrical engineering exp. with at least three years' apprenticeship. In addition, all candidates should have been employed for min. of two years with well established engineering concern and gained wide exp. in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects between ages 25 and 45. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D 128/1A. Selection will be by interview in London and certain expenses will be reimbursed. (A 205)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

CROYDON "B" POWER STATION
Vacancy No. 60A/61.

OPERATION SUPERINTENDENT

APPLICANTS should have sound operating experience in a Generating Station, preferably with P.F. boilers and should hold H.N.C. Electrical or Mechanical. Considerable experience of labour control is essential.

Salary: N.J.B. Class J, Grade 4, £1,595/£1,780 per annum, including London Allowance.

Applications, giving age and full details of experience, qualifications, etc., with supporting standard application form, if available, should be sent to the Station Superintendent, Croydon "B" Power Station, Beddington Farm Rd, Croydon, Surrey, to arrive by 19 April. (A 301)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointments:

THIRD ASSISTANT ENGINEERS
(DESIGN AND CONSTRUCTION)
(S.V. No. 1473)
DIVISIONAL ELECTRICAL DEPARTMENT
COCKFOSTERS (NORTH LONDON)

Salary: N.J.B. Class AX, Grade 6, Scale 12, £1,335/£1,550 per annum (inclusive of London Weighting).

The duties of the successful applicants will include the supervision of the preparation of preliminary and final layout drawings and schematic diagrams, the detail specification of all electrical equipment at Grid Substations and the conduct of technical correspondence with manufacturers.

Applicants should have qualifications equivalent to Graduate Membership of the Institution of Electrical Engineers and must have had experience in the design or construction of transmission works.

STATION CHEMIST
(S.V. No. 1474)
WEST THURROCK GENERATING STATION
(GRAYS, ESSEX)

Salary: N.J.B. Class M, Grade 6, Scale 15, £1,710/£1,890 per annum (inclusive of London Weighting).

Applicants must have had extensive experience in organising the chemical services of a modern generating station, including laboratory management and the control of water treatment plant. Experience in the commissioning of new plant would be an advantage.

Applicants should include details of past experience and a brief description of any investigations or original ideas relevant to generating station chemistry, which the applicant may have pursued.

Applicants should have recognised qualifications in chemistry and the Higher National Certificate is the minimum required.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)
(S.V. No. 1476)
LITTLE BARFORD GENERATING STATION
(ST. NEOTS, HUNTS)

Salary: N.J.B. Class J, Grade 9, Scale 9, £1,115/£1,245 per annum.

Applicants should have served an apprenticeship and have had experience in the maintenance of the electrical plant in a large modern generating station.

Applicants should possess the Higher National Certificate in Electrical Engineering or equivalent qualification.

Housing accommodation may be available for the successful applicant.

Applications, quoting the appropriate reference S.V. No., stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 15 April, 1961. (A 292)

LONDON ELECTRICITY BOARD
DEMONSTRATOR

APPLICATIONS are invited for the above position in the Board's South Western District. Initially, the successful candidate will be based at 204 Lavender Hill, Battersea, S.W.11, but may be required to work at any Showroom within the District.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate, including Electrical Housecraft, and have experience in conducting demonstrations at Showrooms and general Showroom duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the Showroom and on consumers' premises.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £600/£700 per annum, plus the appropriate London Area Allowance.

Applications stating age, qualifications and experience, should be sent to the Manager at the above address. Please quote ref: PER/V/3220/T. (A 271)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointments in the Divisional Electrical Department:

FOURTH ASSISTANT ENGINEERS
(TELECOMMUNICATIONS)
(S.V. No. 1468)

Salary: N.J.B., Class AX, Grade 9, Scale 9, £1,005/£1,245 per annum.

The applicants appointed will be based at either Cockfosters (North London), Bedford, Ipswich or Luton.

The salary for the post at Cockfosters will be subject to an addition of £50 per annum in respect of London Weighting.

Applicants should preferably possess qualifications leading to Graduate Membership of the British Institution of Radio Engineers, or the Institution of Electrical Engineers. Consideration will, however, be given to candidates well advanced in studies for Higher National or City and Guilds Certificates.

The successful applicants will be required for installation, maintenance fault clearance, testing and commissioning of a variety of telecommunications equipment, including auto-telephony, telemetering, remote control systems, power line carrier equipment, V.H.F. radio, etc.

Experience in one or more of these fields is desirable. A knowledge of the Generating Board's standardised system of indications, telephony and telemetering would be an advantage.

Applications, quoting Reference S.V. No. 1468, and indicating the location of the post for which they wish to be considered, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 6 May, 1961. (A 291)

SIERRA LEONE GOVERNMENT
Electricity Department
STATION SUPERINTENDENTS

REQUIRED on contract for two tours of 18-24 months each in first instance. Gross salary according to age and experience in scale rising to £1,528 a year. Gratuity at rate 15% of total salary drawn. Outfit allowance £60. Children's allowances £48/£288 a year. Free passages. Liberal leave on full salary.

Candidates, between 21-40 years of age, must have served full apprenticeship with electrical engineering company and have had several years' experience of operation and maintenance of power stations in a responsible position. They should preferably hold M.O.T. Cert. (Steam and Diesel) or equivalent. Good knowledge of power station electrical equipment desirable.

Newly qualified Mechanical Engineeers with some practical experience in steam turbines will be considered.

Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/50789/EE. (A 303)

CORPORATION OF GLASGOW
Architectural and Planning Department
ASSISTANT ENGINEER (ELECTRICAL)

APPLICATIONS for the above superannuable appointment are invited from graduates and associate members of the Institution of Electrical Engineers. Salary scale: £850/£1,560, with placing according to qualifications and experience. There is a point within the scale at which increments may be accelerated.

A five-day week is in operation.

Advances up to 100% of valuation will be made available where needed for the purchase of suitable houses in or near Glasgow, to successful applicant.

Form of application may be obtained from the Principal Administrative Officer, Architectural and Planning Department, 20 Trongate, Glasgow C.1.

A. G. JURY,
City Architect and Director of Planning.
(A 228)

YORKSHIRE ELECTRICITY BOARD
No. 1 (Bradford) Sub-Area
SENIOR ASSISTANT ENGINEER
(DISTRIBUTION DESIGN)

APPLICANTS should preferably be Corporate Members of the Institution of Electrical Engineers or hold an equivalent qualification. They must have sound experience of extensive distribution networks operating at High and Medium Voltages, and must be capable of organising and administering efficiently, under the Sub-Area Engineer, the Sub-Area Distribution Design Department.

Salary: N.J.B. Class L, Grade 4 (Scale 16), £1,795/£1,950 per annum.

KEIGHLEY DISTRICT
SECOND ASSISTANT DISTRICT ENGINEER

Applicants should have technical qualifications equivalent to those required for Corporate Membership of the Institution of Electrical Engineers and have experience in the design, construction, maintenance and operation of alternating current H.V. and L.V. underground and overhead distribution systems both in Urban and Rural Areas, Substation plant and ancillary equipment. Experience of substantial M.V. direct current distribution will be an advantage. The successful applicant will mainly be concerned with network planning.

Salary: N.J.B. Class F, Grade 7 (Scale 8), £1,040/£1,165 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford 1, not later than 21 April, 1961.

No. 4 (Leeds) Sub-Area
WETHERBY DISTRICT (GARFORTH)
THIRD ASSISTANT ENGINEER

Applicants should possess a good general and technical education and have had experience in the construction, operation and maintenance of e.h.v. and m.v. overhead and underground distribution systems in a mixed urban and rural district.

The successful candidate will be required to reside in the locality.

Salary: N.J.B. Class F, Grade 9 (Scale 6), £890/£1,015 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 21 April, 1961. (A 295)

CENTRAL ELECTRICITY GENERATING BOARD
London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London Allowance. Qualifications entitling to Corporate Membership of the I.E.E. or I.Mech.E. an advantage.

THIRD ASSISTANT ENGINEER
ELECTRICAL DEPARTMENT
(SYSTEM DEVELOPMENT SECTION)
DIVISIONAL HEADQUARTERS
GENERATION HOUSE
Vacancy No. 61/186.

Applications are invited for the post of Third Assistant Engineer in the above section. The successful applicant will be required to carry out duties connected with the preparation of system reinforcement schemes entailing technical and economic appraisal of schemes and the preparation of reports. Applicants should have experience in the manufacture and testing of electrical equipment in the supply industry, and should be familiar with symmetrical component theory and methods of network analysis. They should have qualifications in electrical engineering equivalent to Corporate Membership of the Institution of Electrical Engineers. Salary: Class BX, Grade 8, £1,155/£1,460 per annum.

Applications, quoting vacancy number, may be made to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London W.1, by 18 April, 1961. (A 297)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified engineers for the following appointments which are subject to the conditions of the National Joint Board.

Wear Sub-Area

THIRD ASSISTANT ENGINEER
SUB-AREA ENGINEER'S STAFF
OPERATION AND MAINTENANCE SECTION
SUB-AREA HEADQUARTERS, SUNDERLAND

The successful applicant will be required to assist with the operation and maintenance of h.v. and l.v. overhead and underground distribution networks and substations, up to and including 66 kV.

Salary: Schedule A, Class L, within Grades 10-11, £1,115/£1,325 per annum.

It is not necessary for applicants to previous advertisement for above appointment to re-apply.

THIRD ASSISTANT DISTRICT ENGINEER
DURHAM

Applicants must have had sound practical training and experience in the construction, operation and maintenance of h.v., m.v. and l.v. overhead and underground distribution networks, substation plant and auxiliary equipment.

Salary: Schedule A, Class G, Grade 9, £965/£1,090 per annum.

Applications stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (A 324)

PIONEER ELECTRIC

CANADA

Senior transformer design engineer wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience ten years in design of 5 kVA to 50 MVA transformers.

Switchgear design engineer wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience five years or more in design of metalclad and metal enclosed switchgear up to 15 kV with some knowledge of high voltage circuit-breakers preferred.

Salaries $6,500 to $9,000, depending on qualifications. Full details including photo re education and experience to Pioneer Electric Limited, 1 Rockwood Pl, Winnipeg 19, Manitoba, Canada. (A 162)

ELECTRICAL SUPERINTENDENT

Leading and old-established manufacturers of animal feeding stuffs wish to appoint an Electrical Superintendent for their new Liverpool Mill, now in the course of construction. Minimum qualification H.N.C. Preferred age 30-35. A sound electrical engineering training is essential which, with subsequent experience, should have included planning, installing and maintaining H.V. and M.V. Switchgear, wiring, motors, control gear instrumentation and electronic equipment in heavy industrial practice.

The successful applicant will assist in checking circuit diagrams, in supervising electrical contractors' installation work and in testing and commissioning all electrical equipment for the new Mill. Subsequently, he will be responsible to the Works Engineer for all electrical maintenance work. Comprehensive contributory pension scheme.

Replies giving age, qualifications and experience should be submitted, in confidence to:—

Senior Personnel Manager,
R. SILCOCK AND SONS LTD.,
56 Great Howard Street, Liverpool 3.
(A 321)

BRITISH STANDARDS INSTITUTION

Hemel Hempstead Centre

ELECTRICAL ENGINEER

REQUIRED by the B.S.I. in connection with their testing station at Hemel Hempstead. The work is related to the examination of electrical equipment being exported and the approval of manufacturers applying for licences under the B.S.I. Certification Mark Schemes.

The duties will include visiting manufacturers' works to carry out engineering investigations and also the control of testing work at the Hemel Hempstead laboratories. All types of equipment, including domestic and industrial, are involved, and the work is varied and interesting.

A student apprenticeship and/or testing experience at manufacturers' works or in laboratories is desirable, and the minimum academic qualification is graduateship of the Institution of Electrical Engineers or its equivalent.

The starting salary will be commensurate with qualifications and experience. The post is pensionable.

Apply to the Establishment Officer, B.S.I., 2 Park St, London W.1, quoting reference H.H. (EL). (A 323)

APC

COMMISSIONING ENGINEERS AND ASSISTANT COMMISSIONING ENGINEERS

Vacancies exist on the Commissioning Staff of Atomic Power Constructions Limited, the work being initially in London and later on the site at Trawsfynydd Nuclear Power Station. Candidates should have had operating experience of power station plant, or large industrial plant. They should preferably have corporate membership of the appropriate engineering institution, or have qualifications leading to it. Experience of nuclear power plants will be an advantage, although training in nuclear techniques will be given where necessary.

These positions are on the pensionable staff and carry good prospects of advancement within the Company. Good salaries will be paid and generous allowances made to those engineers transferred to site.

Applications should be addressed to:—

The Personnel Manager,
(Ref. ET/170),
Atomic Power Constructions Ltd.,
P.O. Box 90,
28 Theobalds Road,
London, W.C.1. (A 286)

SURREY EDUCATION COMMITTEE

Richmond Institute of Further Education, Kew Road, Richmond

REQUIRED 1 Sept., 1961:

ASSISTANT LECTURER
GRADE A

to teach mainly practical subjects in Electrical Installation, some elementary Electrical Theory. Should have practical experience in Electrical Contracting Industry, and C. and G. qualification in Electrical Installation work and/or National Certificate in Electrical Engineering. Burnham Technical Scale, £520/£1,000, plus London Allowance, commencing salary according to training and experience.

Further particulars and application form from Principal to be returned by 21 April. (A 288)

BISRA

ELECTRICAL ENGINEER, PHYSICIST, FUEL TECHNOLOGIST

The Furnaces Section of the Steelmaking Division of B.I.S.R.A. is engaged in improving the operating efficiency and control of electric arc, fuel-fired and oxygen-blown furnaces for steelmaking. The work, carried out in its laboratories in Sheffield and in steelmaking plants, offers considerable scope for initiative in tackling an important aspect of steelmaking technology.

Because of expansion of effort the Section has need of a qualified research worker to be responsible to the Head of the Section for the conduct of investigations. The successful applicant should be an electrical engineer, a physicist or a fuel technologist, preferably with experience in more than one of these fields. Initial salary will be up to £1,000 per annum according to age, qualifications and experience, and there are excellent opportunities for advancement. The post is superannuated under the F.S.S.U.

Written applications only, quoting "S.M.19." to the Personnel Officer, The British Iron and Steel Research Association, 11 Park La, London W.1. (A 319)

FOSTER WHEELER LIMITED

have immediate vacancies for

DESIGN DRAUGHTSMEN, DRAUGHTSMEN AND MATERIAL CONTROLLERS

for the Electrical Section of the Process Plants Division.

The work is in connection with Oil Refineries and Petro-chemical Plants and it is essential that applicants should have had experience of large industrial electrical installations.

These are permanent positions offering good salaries, commensurate with experience.

New offices, five-day week, Pension and Life Assurance Schemes, Luncheon Vouchers, Bonus Scheme.

We shall be pleased to arrange evening interviews.

Please write fully, giving age, qualifications and experience, and quoting Ref.: 59/AK, to: Office Manager, FOSTER WHEELER LTD., Foster Wheeler Hse, Chapel St, London N.W.1 (adjacent to Edgware Rd Station). (A 333)

ELECTRICAL CONTRACTS ENGINEER

required to act as Assistant to Electrical Contracts Manager.

Candidates should be up to the age of 35 and have served a recognised apprenticeship with a reputable *electrical contractor* followed by at least two years' supervisory duties.

Preference will be given to candidates having a good technical education and experience of industrial and flame-proof installations. Good salary and contributory pension scheme.

Please write, stating age, qualifications, experience and present salary, to:

The Personnel Manager,
CONSTRUCTORS
JOHN BROWN LIMITED,
C.J.B. House, Eastbourne Terrace,
Paddington, London, W.2
quoting Ref. No. K7992.

(A 232)

BICC

BRITISH INSULATED CALLENDER'S CONSTRUCTION CO., LTD.

SITE ENGINEERS

required for the supervision of Power Cable Installation Contracts in various parts of United Kingdom. Contracts cover supertension underground cable routes and Power Station cabling. Applicants should be experienced in cable installation technique and in the control of labour.

ESTIMATORS

for the Overhead Line Contracts Department. Applicants should be accurate and quick with figures and capable of dealing with the necessary correspondence. Some knowledge of overhead line work is desirable but not essential.

Apply in writing to:

The Personnel Officer,
British Insulated Callender's Construction Co. Ltd.,
30 Leicester Sq,
London W.C.2.

(A 304)

PIRELLI-GENERAL CABLE WORKS LTD.

Have a vacancy in their Testing and Inspection Department at Eastleigh Works for a

CABLE TESTING ENGINEER

For carrying out high voltage acceptance tests and fault location after installation.

The Company is prepared to offer training to a suitable candidate.

Applicants should have O.N.C. (Elect. Eng.) and should be able to drive a car. The duties will involve travelling to all parts of the country.

Letters of application should be addressed to:

The Personnel Manager,
Pirelli-General Cable Works Ltd.,
Southampton.

(A 302)

ELECTRICAL DEVELOPMENT ASSOCIATION

ASSISTANT DIRECTOR

The Chairman and Council of the British Electrical Development Association invite applications for a new appointment as Assistant Director.

The Association, formed in 1919 to promote the increased use of electricity, is supported by the Electricity Supply Industry in Great Britain and Ireland. Its objects are to develop all forms of electricity utilisation, principally through Press advertising campaigns, exhibitions, publications, the sponsorship of films and by other means of educational and advisory work.

The successful candidate will need to have had extensive executive experience in responsible positions in the electrical industry, ability in the field of public relations and a full measure of initiative, enthusiasm and imagination. Powers of negotiation and organisation, a co-operative spirit and the ability to speak in public are also essential. It follows in view of this experience that his age will be in the region of 45-55. The salary will depend upon qualifications, but a minimum of £3,500 p.a. is envisaged with appropriate superannuation benefits.

Applications (the closing date for which will be 24 April) with full details of education and professional qualifications, training and subsequent career and present salary, should be clearly marked "Assistant Director" and addressed to:

Director and Secretary,
Electrical Development Association,
2 Savoy Hill, London W.C.2.

(A 312)

MANAGING ABILITY

We require a man with management ability. To this attribute must be added a comprehensive knowledge of the electrical and electronic equipment in modern ships. In addition, the position requires patience, tact, resource, perseverance and the ability to lead a large number of men.

The position is overseas in a congenial climate suitable for a family man.

It should be obvious from this advertisement that we are looking for a man of good general education and membership of the Institution of Electrical Engineers or equivalent.

If you are of this standard why not apply; we guarantee strict confidence. Anyone not fulfilling these requirements is asked not to apply.

Write Box ET444, c/o Hanway Hse, Clark's Pl, London E.C.2.

(A 320)

South Western ELECTRICITY

DISTRICT MANAGER, BRISTOL

Applications are invited from suitably qualified persons for the post of District Manager, Bristol, which will shortly fall vacant following the appointment of Mr. A. G. Milne as Chief Engineer of the London Electricity Board.

The salary scale for this post is £3,040/£3,270 per annum, within Class F, Grade 6, of the N.J.M.C. Agreement.

The District Manager's headquarters will be at Bristol and the District includes four Commercial Districts, each of which has a Manager graded within the N.J.M.C. Agreement.

He will be responsible to the Chairman for the efficient operation of the District and for the maintenance of a high standard of consumer service.

The duties will include promotion, planning and execution of an efficient and economical distribution of an electricity supply throughout the District, with negotiation, planning and implementation of Rural Development Schemes and the preparation of, and adherence to, capital and revenue budgets. This will involve the efficient co-ordination of the work of the engineering, commercial, financial and secretarial staff within the District.

Other responsibilities will include the maintenance of good relations with employees and their Trade Union Organisations on a positive basis and also Local Authorities, the Public, Local Representative Bodies including the Consultative Council, and the Local Press.

In view of the responsibilities attached to this appointment, applicants must possess a wide engineering and commercial experience and administrative ability. Corporate Membership of the Institution of Electrical Engineers is most desirable.

Detailed applications stating age, present post and salary, qualifications and past experience should reach the Establishments Officer, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1, by 22 April, 1961.

(A 313)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

DEMONSTRATOR—BEDFORD DISTRICT

66/61.R.

Applicants should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate; should be able to assist in building the domestic load by studying new housecraft techniques and new electrical appliances and by helping housewives to select, buy and use efficiently the appliances most suited to their needs.

Salary: N.J.C. Grade 1 (£600/£700).

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 21 April, 1961.

SENIOR DEMONSTRATOR
LUTON DISTRICT

64/61.R.

The duties are mainly concerned with the sales development of all types of domestic appliances and the promotion of demonstrations in the Board's showrooms and in suitable halls to further this end.

Applicants should have had a sound training in domestic science and hold a recognised diploma. They should be capable of arranging and giving talks on domestic electrical subjects to women's organisations, school authorities and groups of students.

Salary: N.J.C. Grade 2 (£700/£775).

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487 Dunstable Rd, Luton, by 21 April, 1961.

Essex Sub-Area

FOURTH ASSISTANT ENGINEER
SOUTHEND DISTRICT

63/61.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary: N.J.B. Class H, Grade 11 (£890/£1,015).

Apply by letter giving age, experience and present employment to J. Linton, A.H.W.C., M.I.E.E., A.I.MECH.E., Manager, Southend District, Eastern Electricity Board, 85 London Rd, Southend-on-Sea, Essex, by 21 April, 1961.

Northmet Sub-Area

THIRD ASSISTANT ENGINEER
ENFIELD DISTRICT

65/61.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class G, Grade 9 (£965/£1,090), plus London Allowance.

Apply by letter to A. T. Durbridge, Manager, Eastern Electricity Board, Enfield District, 40 Church St, Enfield, Middx, by 21 April, 1961. (A 317)

THE SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following posts:

(a) ASSISTANT COMMERCIAL ENGINEER
BARRY DISTRICT

The duties of this post will be of a general nature, and preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class F, Grade 9, Scale 6 (£890/£1,015 per annum).

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Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445-447 Cowbridge Rd East, Cardiff, to arrive not later than 22 April, 1961. Please quote reference 42/61/ET, endorsing envelope "Assistant Commercial Engineer."

(b) THIRD ASSISTANT ENGINEER
(CHIEF DRAUGHTSMAN)
HEAD OFFICE, ST. MELLONS

The person appointed will be responsible for the control and supervision of Cartographical and Engineering Draughtsmen, and generally assisting the Chief Engineer in the functional control of drawing office practice throughout the Board.

Applicants should have a wide experience of drawing office work in electricity distribution, have held a supervisory position in a drawing office, and should hold a Higher National Certificate in Electrical Engineering, or equivalent.

Salary: N.J.B. AX.6, Scale 12 (£1,350/£1,500 per annum).

(c) GENERAL ASSISTANT ENGINEER
(DRAUGHTSMAN)
HEAD OFFICE, ST. MELLONS

Duties will include the preparation, under supervision, of arrangement drawings of overhead power lines and detailed drawings of associated equipment, substation layout drawings and electrical diagrams.

Applicants should have received appropriate training in this type of work. Preference will be given to those holding a National Certificate in either Electrical or Mechanical Engineering.

Salary: N.J.B. AX.13, Scale 5 (£825/£940 per annum).

Applications stating age, present position, present salary, qualifications and experience, and indicating the post for which application is being made, should be addressed to the undersigned at St. Mellons, Cardiff, to arrive not later than 22 April, 1961. Please endorse envelope "Draughtsman—43/61/ET."

R. G. WILLIAMS,
Secretary.
(A 290)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER

REQUIRED at Bangor. Salary within the range £765/£870 per annum (N.J.B. F.11, Scale 4).

Applicants should have completed a recognised electrical apprenticeship and had some technical training. Duties will include estimating, preparation of specifications and supervision of contracting work, advising consumers on matters relating to electricity supply and the utilisation of electricity. The ability to speak Welsh and to drive would be an advantage.

The work is of an interesting nature, and the post is pensionable, with good working conditions and reasonable future prospects to suitable staff.

Appointment subject to medical examination.

Application forms obtainable from the Manager, No. 4 Sub-Area, Rhostyllen, nr. Wrexham.

Closing date: 20 April, 1961. (A 315)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted superannuable appointments:

(1) SENIOR ASSISTANT ENGINEER
PLANNING AND ECONOMICS SECTION
CHIEF COMMERCIAL OFFICER'S DEPARTMENT
AT BOARD HEADQUARTERS
(Ref. C2/61)

Applicants should have had experience in the generation and distribution sides of an electricity supply organisation and should possess a good knowledge of statistical theory, costing, supply economics and tariff design. The duties will include commercial studies on generation economics, supervision of programmes of utilisation research and the statistical analyses of the data, and the design of bulk supply and retail tariffs.

Corporate membership of either the Institution of Electrical Engineers or the Institution of Mechanical Engineers is desirable.

Salary: N.J.B. Class BX, Grade 3, £1,570/£1,950 per annum.

(2) ASSISTANT SHIFT CHARGE ENGINEER
HUNTERSTON NUCLEAR GENERATING STATION
(Ref. G12/61)

The successful applicant will be responsible for delegated duties while on shift in the operation of both nuclear and conventional plant. The minimum technical standard will be the possession of a Higher National Certificate. Previous experience in power station operation is essential. The successful candidate will be given a course in the operation of nuclear reactors.

Salary: N.J.B. Class M, Grade 8, £1,440/£1,610 per annum, plus shift allowance of 10% per annum while on shift duties.

Persons who made application for the above position when previously advertised will be reconsidered without further application.

Applications, quoting appropriate reference, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 21 April, 1961. (A 326)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPLICATIONS are invited for the position of

INSTRUMENT ENGINEER

at Ironbridge Power Station, Buildwas, Salop. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J.10, £1,040/£1,165 per annum.

Applicants must have had experience in the operation and maintenance of all types of power station instruments (excluding electrical instruments), and should preferably hold the Higher National Certificate in Mechanical Engineering or equivalent qualifications.

Apply, quoting Vacancy No. 93/61MD, on form AE6/ACT, available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, by 24 April, 1961. (A 325)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

MECHANICAL MAINTENANCE ENGINEER
PORTSMOUTH GENERATING STATION

SEC./3.142.

APPLICANTS should have had considerable experience in the maintenance of generating station mechanical plant, and must be capable of controlling staff and planning and supervising mechanical plant maintenance.

Candidates should be corporate members of an appropriate professional institution or hold qualifications leading to such membership.

Salary: N.J.B. Grade H.7, Scale 10, £1,190/£1,325.

Special application forms (not AE6/ACT) obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 18 April, 1961. (A 314)

THE EAST MIDLANDS ELECTRICITY BOARD
Nottingham Sub-Area

Vacancy No. 39/61.
FOURTH ASSISTANT ENGINEER
(CONSTRUCTION)

SALARY: N.J.B. Class K, Grade 13, £890/£1,015 per annum.

Applications are invited from suitably qualified and experienced Engineers for the above vacancy.

The successful applicant will be required to assist with construction work associated with 33 kV and 11 kV schemes (substations, underground cables and overhead lines) from the Planning stage to commissioning using either Direct or Contract Labour. Ability to drive a car is desirable.

Vacancy No. 40/61.
SECOND ASSISTANT DISTRICT ENGINEERS

Salary: N.J.B. Class G, Grade 7, £1,115/£1,245 per annum; and N.J.B. Class F, Grade 7, £1,040/£1,165 per annum.

The duties will include Construction, Maintenance and Operation on distribution systems of all voltages up to and including 33 kV.

Ability to drive a car is essential, and the successful applicant will be required to undertake standby duty.

Applications for the above vacancies should be forwarded to The Manager, Nottingham Sub-Area, 35-39 Carrington St, Nottingham, within 14 days of the date of this advertisement. (A 327)

SOUTHERN ELECTRICITY BOARD
DEMONSTRATOR

READING District of No. 2 (Newbury) Sub-Area. Salary: N.J.C. Grade 1 (£600/£700 per annum). N.J.C. Conditions of Service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1309, not later than 17 April, 1961. (A 305)

THE UNITED LIVERPOOL HOSPITALS AND THE SOUTH LIVERPOOL HOSPITAL MANAGEMENT COMMITTEE

APPLICATIONS are invited for appointment to a new post of
ELECTRONICS TECHNICIAN

The work will be associated primarily with the heart departments of the Royal Liverpool Children's Hospital and the Sefton General Hospital.

The duties will include diagnosis of faults, repair, maintenance and calibration of all types of medical/electronic equipment, electrical and general instruments, controllers and recorders; and also the design and construction of components and the modification of machinery and equipment to meet special medical needs. There is scope for the exercise of initiative in a new field of hospital activity and opportunity for innovation and research in collaboration with the medical and technical staffs in the heart departments.

Applicants must possess the Higher National Certificate in Electrical Engineering (with Electronics) and have some relevant practical experience or hold a degree in electrical engineering or be Corporate Members of the Institution of Electrical Engineers.

The salary scale is £800 x £30(5)—£950 a year. The post is superannuable. Whitley Council Terms and Conditions of Service apply.

Apply, stating age, qualifications and experience, and giving the names of three persons to whom reference may be made, to the Secretary, 80 Rodney St, Liverpool 1, by 24 April, 1961. (A 306)

THE EAST MIDLANDS ELECTRICITY BOARD
Coventry Sub-Area

Vacancy No. 38/61.
SERVICE CENTRE SUPERVISOR

SALARY: N.J.C. Grade 5, £1,020 x £30—£1,140 per annum.

The successful applicant, who should have had experience in the operation of a large, busy Service Centre, will be responsible for the supervision of sales staff, planning window displays and sales activity programmes, and should be capable of advising consumers on matters relating to tariffs, hire purchase procedure and the use of electricity in the home.

Applications should be forwarded to the Manager, Coventry Sub-Area, Sandy La, Coventry, to reach him not later than 21 April, 1961. (A 309)

ASSISTANT ENGINEER required for Wood Pole Line Contracts in Scotland. Ref.: J.H.P., B. French Ltd., Kidderminster. (A 330)

CURRENT TRANSFORMER DESIGNER required by Crompton Parkinson Ltd. Consideration would be given to applicant without previous experience, but essential reached H.N.C. standard or equivalent. Write with full particulars to Personnel Officer, Clayton Rd, Hayes, Middlesex. (A 331)

CABLE ESTIMATOR required. State age and experience.—Wandleside Cable Works Ltd., 106 Garratt La, Wandsworth, S.W.18. (A 285)

CABLE FOREMAN required, must be capable of completely running own jobs—employing and dismissal of labour, etc. Work involved if cabling up to and including 11 kV, Street Lighting, Control Cabling and Internal wiring. Must be willing to travel in all parts of the country. Wage according to ability, but in the region of £20 per week plus bonus. Apply in writing, sending any references.—W. T. Parker Ltd., 113/115 Station St, Burton upon Trent. (A 282)

DESIGNER of small transformers 20 VA to 15 kVA coil winding delay lines, instrument transformers—must be experienced in latest designs and high standards—required by Scottish manufacturer to extend range of present lines. Good salary and superannuation. Prospects of future directorship.

Reply in confidence giving full particulars of experience and qualifications to Box No. 8253, Electrical Times. (A 300)

DEVELOPMENT ENGINEER required for design and development of fluorescent chokes and transformers. Apply, stating experience, qualifications and salary, to W. J. Parry and Co. (Nottingham) Ltd., Victoria Mills, Draycott, Derby. (A 294)

ELECTRICAL SENIOR ESTIMATING ENGINEER. First-class situation open large Electrical Company, London. Write age, experience, salary.—Box No. 8237, Electrical Times. (A 191)

ELECTRICAL ENGINEER required for Mechanical Engineering Company who manufacture capital plant for the paper and corrugated board industries. Applicants should possess a Higher National Certificate, have served an apprenticeship preferably with an electrical manufacturer, and have had some practical experience of control gear and rotating machines. The successful candidate, whom we expect to be aged between 24 and 30 years, will join a small department which is responsible for specialised electric drives and control equipment supplied with our products. Written applications to Masson Scott and Co. Ltd., Riverside Rd, Summerstown, S.W.17. (A 307)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ENFIELD-STANDARD POWER CABLES require FOREMEN experienced installation High Voltage Cables, large Contracts. Apply Contracts Manager, E.-S.P.C., Stockingswater La, Brimsdown, Middx. (A 322)

GENERAL FOREMAN required for Wood Pole Line Contracts in Scotland. Ref.: J.H.P., B. French Ltd., Kidderminster. (A 329)

JOINTERS (E.H.T.) required. Previous experience essential. Present rate of pay 5s 6½d per hour. N.J.I.C. Conditions, including 42-hour, five-day week. Holiday and Sick Pay Schemes. Optional Superanuation Scheme. Apply by letter to District Manager, Midlands Electricity Board, 31 High St, Stourbridge, Worcs. (A 308)

OPPORTUNITY for keen young man about 30 to take charge of Sales office of old established firm in Lighting Industry. Experience in lighting fittings. Sales activities desirable but not essential. Applicants must have good knowledge of the Electrical Trade and be accustomed to dealing with Users, Contractors, Architects, etc. Good prospects for keen organiser, five-day week, pension fund. Write fully to Box No. 8245, Electrical Times, stating age, experience and salary range. (A 272)

SENIOR ELECTRICAL CONTRACTING ENGINEER, able to deal Contracts to final Accounts, required South Wales area. Excellent prospects suitable man. Write age, salary, experience.—Box No. 8243, Electrical Times. (A 247)

SURVEYOR required for Wood Pole Line Contracts in Scotland. Ref.: J.H.P., B. French Ltd., Kidderminster. (A 328)

TEST ENGINEER required by well established Company in the South of England for their Current and Power Transformer Test Depts. Applicants should have O.N.C. or similar qualifications. Write, with particulars of education, experience and salary required, to Box No. 8255, Electrical Times. (A 332)

TECHNICAL REPRESENTATIVE, London area required for Company manufacturing special Conduit, Trunking and Wiring Accessories. Age 25-35. Must have installation experience and be able to make contacts at high level. Excellent prospects. Write stating age, experience and salary required to Box No. 8249, Electrical Times. (A 293)

TECHNICAL MANAGER required for West London electrical equipment manufacturing company. Experienced knowledge of circuit-breakers and control gear required, with awareness of the requirements of flameproof equipment. Applications are invited from qualified electrical engineers for this senior appointment, with age not exceeding 45 years. The appointment is pensionable and applicants are requested to submit full details of technical qualifications, experience and training, etc., to Managing Director, c/o Box No. 8251, Electrical Times. (A 299)

APPOINTMENTS WANTED

ESTIMATOR/SUPERVISOR seeks responsible position. Extensive experience including overseas. Box No. 8231, Electrical Times. (A 139)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (A 1)

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INSPECTION AND SPECIFICATION for elec. work; free-lance.—"Beaumont," 334-6 King St, London, W.6. (A 124)

FOR SALE

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, Switchgear, Exhaust Fans, Hoists, Reduction Gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (A 2)

A.C. AND D.C. MOTORS, Generators, new and reconditioned. REWINDS and repairs promptly executed.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566. (A 8)

A.C. AND D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (A 7)

COVENTRY CLIMAX FORKLIFT TRUCKS!!! A choice selection of Petrol and Diesel models. From 1,500 lb to 4,000 lb capacity. 9 ft to 14 ft lifts. Full details and prices from Speed Electrics, Dept. ET, Church St, Basford, Nottingham. Tel.: 75716. (A 249)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey. (A 5)

FLUORESCENT FITTINGS, Shells and Chokes to BS 2818 (Licence No. 3237) Coil Winding, all sheet metal work.—D. E. Cowling & Sons Ltd., Romside Trading Estate, North St, Romford 47282. (A 9)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment. — Universal Electrical, 221 City Rd, London E.C.1. (A 3)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (A 6)

NEW FRACTIONAL GEARED MOTORS, 230 V a.c. s.-ph. 50 c r.p.m. 1, 6, 12 or 20, £3 18s 6d carriage paid.—The Universal Electric Motor Co. Ltd., 2 Constance Rd, Enfield. (A 181)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (A 4)

BUSINESS OPPORTUNITIES

ELECTRIC POWER UNDERTAKING FOR SARK

OFFERS are invited for the outright purchase of the electricity undertaking of Sark. Established in 1948 with local private capital, the network serves 500 resident population with a steadily rising demand. 32,000 visitors come every year from which island hotels cater for 3,000.

Sark, apart from its mild climate and beautiful scenery, is unique among the four Channel Islands. Not only is it completely self-governed democratically, but there are no Death Duties nor Income Tax; no Property nor Profits Tax; there are no Rates nor Social Services; no Company Law nor Trade Unions; there are no motor cars nor building restrictions. In spite of cheap drink and tobacco, there is an annual Budget Surplus. This charming backwater has remained little changed for 400 years

continued in next column

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and Sark, therefore, is becoming increasingly popular with retired people.

The reason for selling is simple. Although there is adequate finance, very healthy profits and technically sound plant planned for easy expansion, the Founder-Owner is considering retiring in Sark; if not now, then in a year or two.

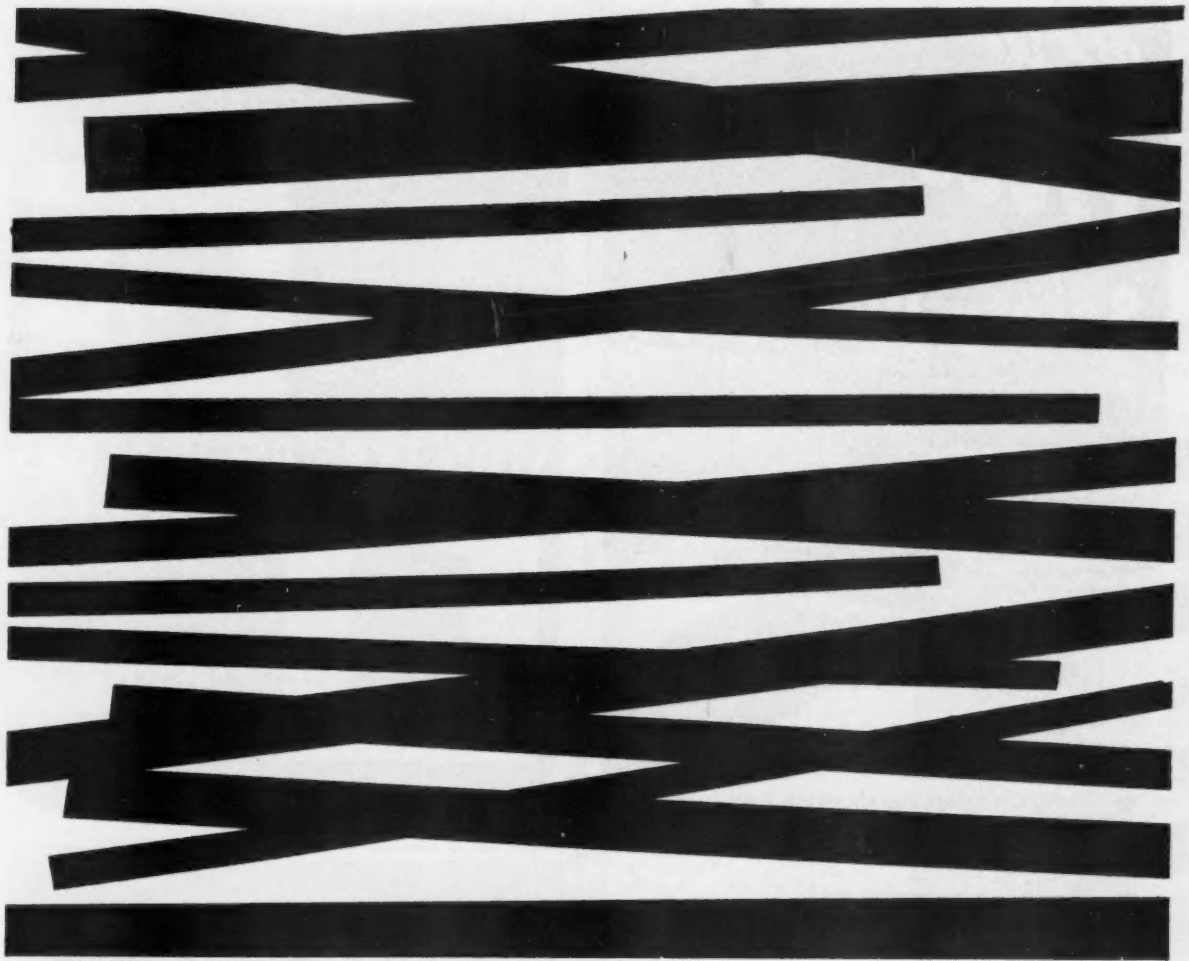
An alternative would be to accept a working partner, with or without capital. In that case, the right man would be middle aged and with the necessary skill and technical knowledge and, above all, a genuine liking for the life here.

In the station there are three National-Fielding Horizontal diesel alternator sets at 62 kWA at 500 r.p.m., 415/3/50 with full metering, shutdown protection and automatic closed circuit cooling. Switchboard and cooling system capacity is 750 kVA and two further 130 kVA sets are planned for 1963 to meet growing demand. Distribution is at 6·6 kV with a capacity of 1,500 kVA. There is a showroom and an office. The undertaking cannot be nationalised nor is the Concession restricted in profits, tariff or term of years.

Robson Electric Supply Co., Sark, Channel Islands (Sark 53). (A 289)

PATENTS

THE proprietor of British Patents Nos. 704893 and 704894, entitled "Automatic Reclosing Electric Circuit Breakers" and "Improvements in Automatic Reclosing Electric Circuit Interrupters," respectively, offers same for licence or otherwise to ensure practical workings in Great Britain. Inquiries to Singer, Stern and Carlberg, 140 S. Dearborn St, Chicago 3, Illinois, U.S.A. (A 287)



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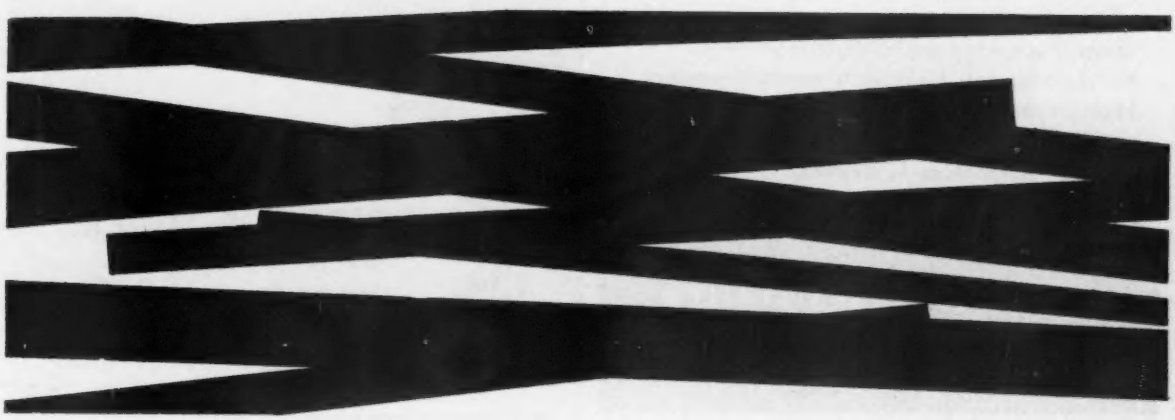

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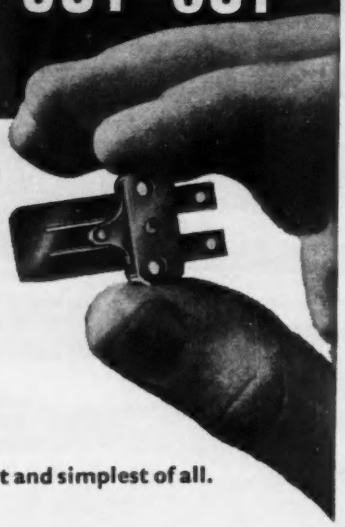

World Patents including Patent Numbers 600055, 622781, 624905, 657434, 713443, 749716, 774911, 782668, and others. Also other patents pending.

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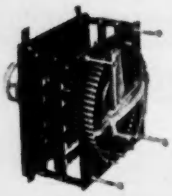

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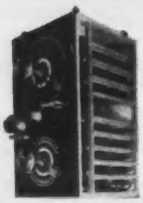

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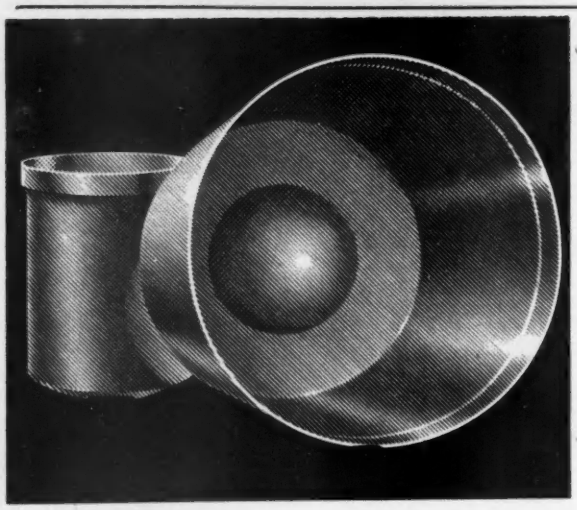

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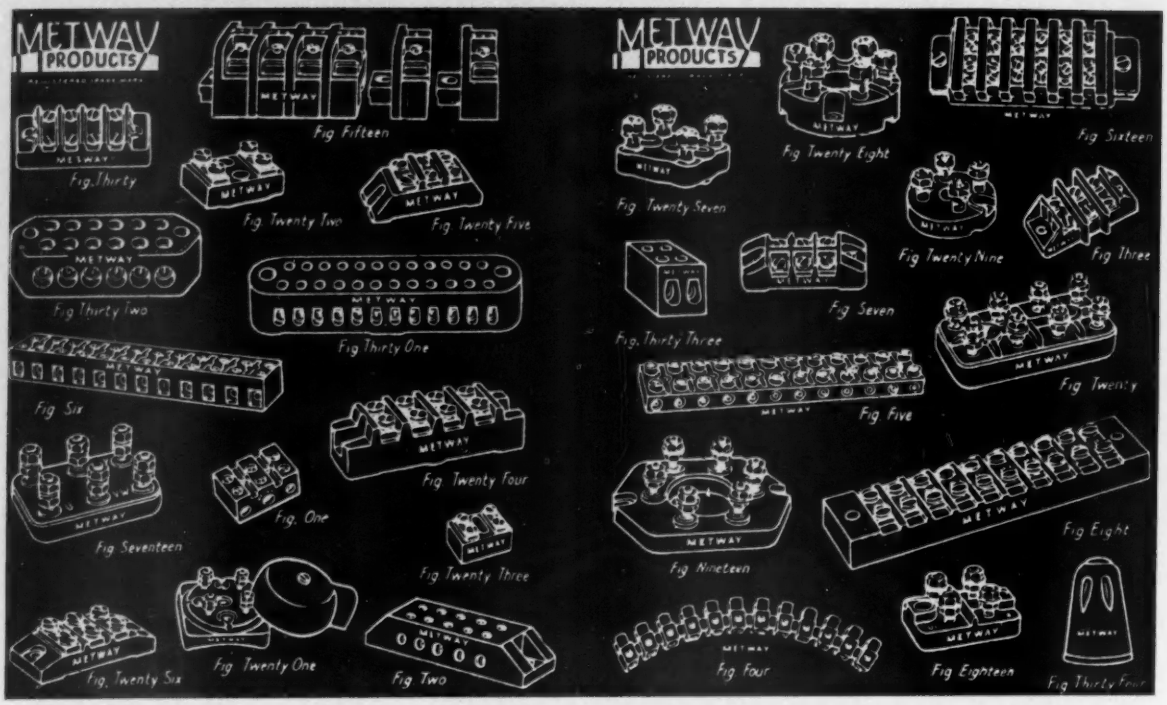

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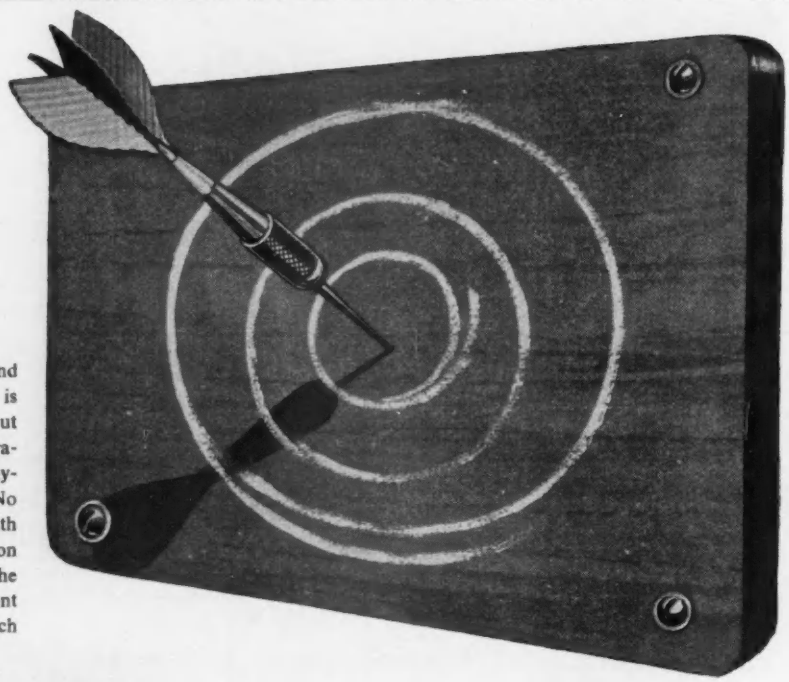

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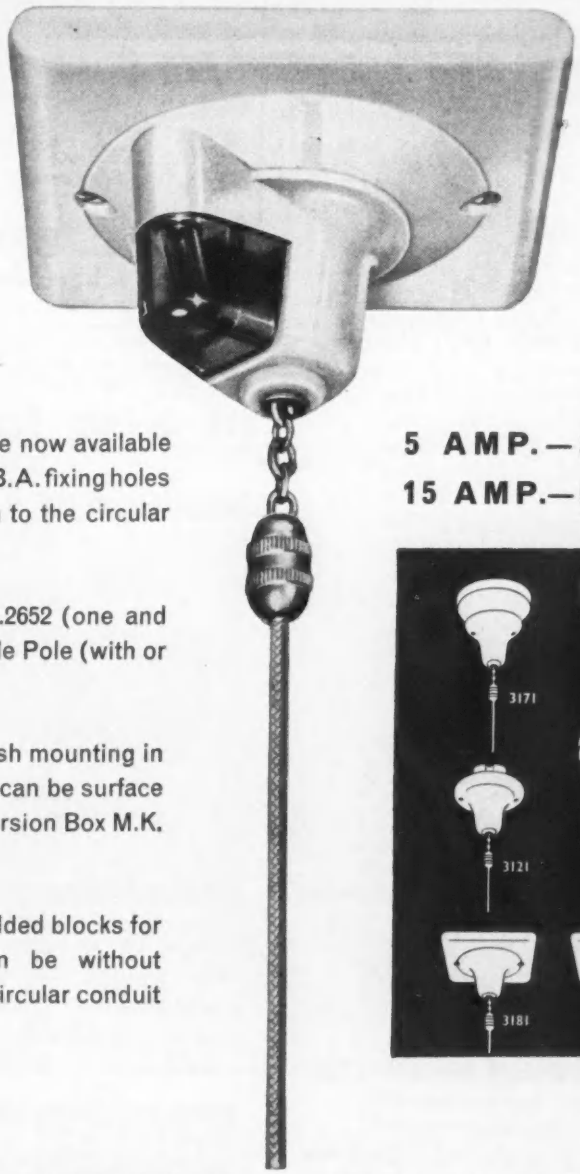

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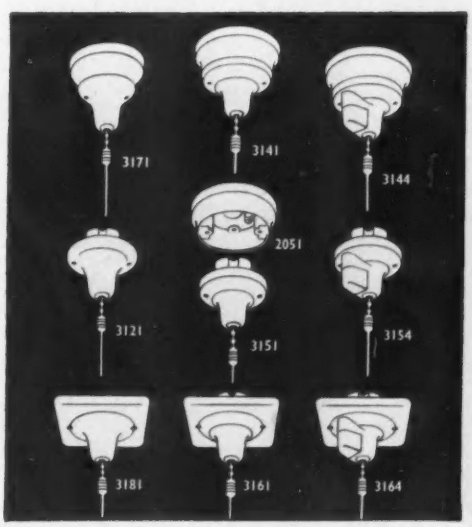

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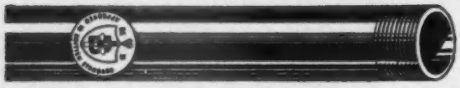

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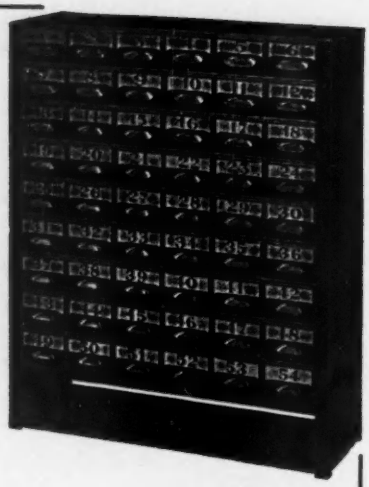

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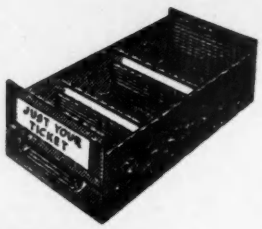

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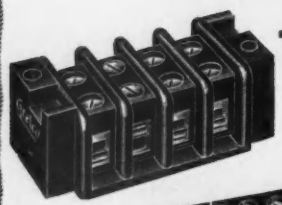

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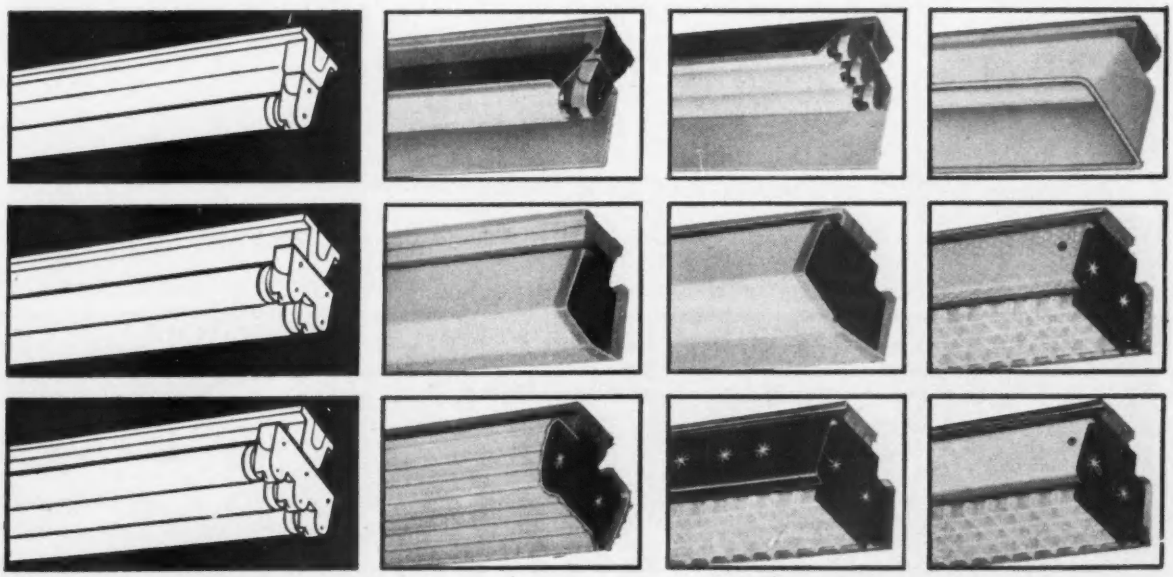

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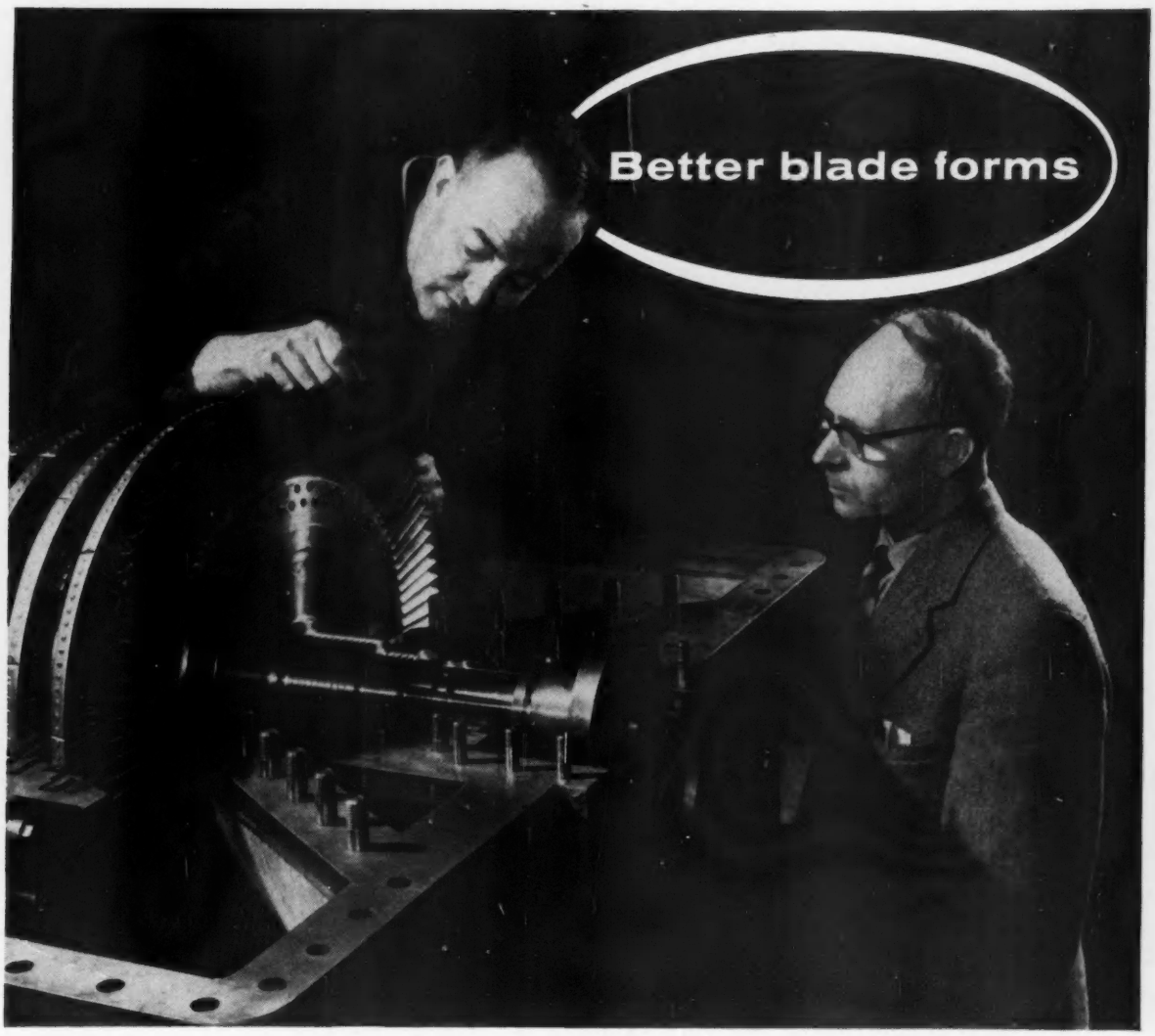

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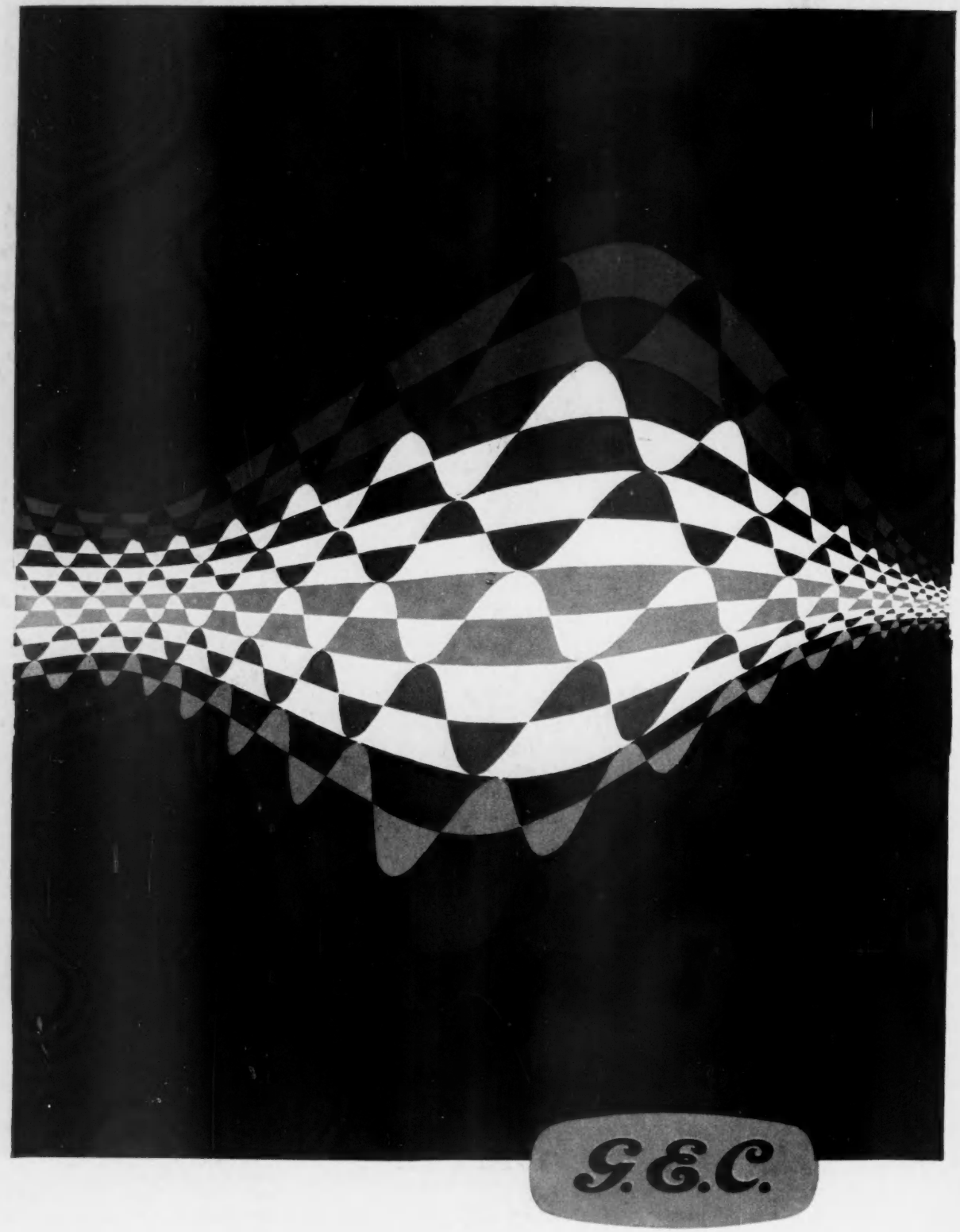

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